Norwich Western Link Environmental Statement Chapter 11: Bats

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Document Reference: 3.11.00

Version Number: 00

Date: March 2024

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Glossary of Abbreviations and Defined Terms

Term	Definition
ADS	An automated static detector (ASD) is a piece of survey equipment used to gain a representative sample of activity to assess the species assemblages and distribution of summer activity at numerous locations.
AQ	Air Quality
BAG	An independent Bat Advisory Group (BAG) was formed during 2021 to gain independent review and assessment on survey effort and approach, mitigation and compensation design and share best practise, current research, and worked examples of mitigation and compensation during the pre-planning stages of the Proposed Scheme. The BAG will continue during planning, and during construction and operation of the Proposed Scheme to review the monitoring of the Proposed Scheme mitigation measures, and advise on and agree any remedial actions, which may be required. The BAG will meet with the Named Ecologists during construction and the monitoring period to assess the ongoing mitigation.

Term	Definition
BAP	A Biodiversity Action Plan (BAP) details the proposed actions for the conservation of threatened species and habitats. The UK BAP was originally produced in 1994. In additional local BAPs were created by local authorities and wildlife trusts to detail threatened species and habitats specific to their local areas. In the context of the Proposed Scheme, the Norfolk BAP (NBAP) is the local BAP. The UK BAP was superseded by the UK Post-2010 Biodiversity Framework, which was produced in 2012. However, the BAP species and habitats remain relevant and priority species and habitats, now often referred to as Species of Principal Importance (SPI) and Habitats of Principal Importance (HPI).
BCT	The Bat Conservation Trust (BCT) is a registered charity, which works for the conservation of bats and their habitats within the UK. BCT produced best practice guidance for bat survey methodologies and mitigation.
BNMMP	The Bat Noise Monitoring and Management Plan (BNMMP) for the Proposed Scheme will detail relevant measures and buffers to avoid and / or reduce the effects of higher-risk activities during construction such as piling. This will include individual assessments for sensitive areas across the Proposed Scheme.

Term	Definition
BMG	The Bat Mitigation Guidelines (BMG) were produced to assist with assessing the potential impacts on bats of a proposed development and identifying appropriate mitigation. Both the original BMG 2004 (Mitchell-Jones A.J, 2004) and the updated version published in 2023 (Reason, P.F. and Wray, S., 2023) have been taken into account within this assessment.
BPM	Best Practicable Means (BPM) relates to the best measures which can be practically implemented to reduce risk of environmental harm in consideration of local conditions, technical knowledge, and social and economic factors. BPM is defined in the Environmental Protection Act 1990. In relation to the Proposed Scheme, BPM relate to the proposed mitigation to manage noise and vibration.
BTHK	The Bat Tree Habitat Key (BTHK) is a project which collates evidence of UK bats in trees to try and identify patterns of use, and thereby improve assessment of roost resource value.
CEDR	The Conference of European Directors of Roads (CEDR) is an organisation of European national road administrations which shares knowledge and best practices relating to road management, collaborates on joint projects and promotes excellence in road management. The CEDR produced an assessment and guidance for bat mitigation measures on roads (CEDR, 2016).

Term	Definition
CIEEM	Chartered Institute of Ecology and Environmental Management (CIEEM) is a membership body for ecologists and environmental managers within the UK and Ireland. CIEEM has produced best practice guidance relating to Environmental and Ecological Impact Assessments (EIA and EcIA) and the production of Environmental Statements (ES).CIEEM were also responsible for publishing the updated 2023 BMG (Reason, P.F. and Wray, S., 2023).
CLMP	A Construction Lighting Management Plan (CLMP) will describe the measures that will be implemented to minimise the potential impacts on bats from lighting in line with best practice guidance (ILP, 2023). This is likely to include avoidance of night-time working in important areas, controlling the location and direction of lighting, and avoiding light spill over important bat habitats.

Term	Definition
Compensation Extent	The areas of environmental mitigation, compensation, and enhancement, that fall within the Red Line Boundary and outside of the Site Boundary. This includes the land required for habitat creation, habitat improvement and installation / creation of bat mitigation features including bat boxes and veteran features and includes a number of existing woodland blocks, areas of arable / grass fields and existing hedgerows which will be subject to habitat improvement works. The compensation extent discussed within this chapter and associated appendices focuses on bat mitigation, compensation, and enhancement. However, this bat Compensation Extent, falls within the Essential Environmental Mitigation Plan (detailed below).
Competent Authority	A competent authority is an organisation that has the legally delegated or invested authority to perform a designated function. In terms of a Habitats Regulation Assessment (see definition below), a competent authority is considered to be a competent public body, for example the local planning authority. Linked to the Essential Environmental Mitigation description detailed below.
CPO	A Compulsory Purchase Order (CPO) is a legal order, which allows acquiring authorities to acquire land or property without the consent of the owner to support the delivery of developments in the public interest.

Term	Definition
cSAC	Candidate Special Areas of Conservation (cSAC) are sites which were submitted to the European Commission before the end of the Transition Period following the UK's exit from the EU, but not yet formally designated.
CSZ	A Core Sustenance Zone (CSZ) is the area surrounding a bat roost within which habitat availability and quality will have a significant influence of the resilience and conservation status of the colony using the roost. CSZs are a BCT concept, based on an extensive literature review, and are described in the BCT good practice guidelines (Collins, 2023).
CWS	County Wildlife Sites (CWS) are non-statutory designated sites which are designated for their wildlife value at a county level. While CWSs are not afforded any statutory protection, they are protected through the planning system and local planning policies.
D	In the context of this Environmental Statement, D refers to Direct ecological affects.
DCO	A Development Consent Order (DCO) is a form of permission for developments which are considered to be Nationally Significant Infrastructure Protects (NSIP). DCOs were introduced through the Planning Act (2008) in order to create a single process to gain all necessary consents and powers to allow a proposed scheme to proceed.

Term	Definition
DMRB	The Design Manual for Roads and Bridges (DMRB) details the current design standards and advice relating to the design, assessment and operation or motorways and all-purpose trunk roads and bridges in the UK.
EcIA	An Ecological Impact Assessment (EcIA) is a process of identifying and assessing the potential effects of a development on habitats, species, and ecosystems. An EcIA may form a standalone document or may form a chapter or section of an Ecological Impact Assessment (EIA). An EcIA will include scoping the matters to be addressed, setting out an established baseline and identifying Important Ecological Features (IEFs), and an assessment of impacts on the IEFs. The EcIA will also include mitigation, compensation, and enhancement measures.
EIA	An Environmental Impact Assessment (EIA) is a process for identifying and assessing the potential impacts of a proposed project or development. The requirement for an EIA is set out in the Town and Country Planning (Environmental Impact Assessment) Regulations 2017. Where an EIA is required, an Environmental Statement must be produced.
ELG	An Ecology Liaison Group (ELG) in the context of the Proposed Scheme, is a group set up to provide an in-depth local knowledge of ecological matters. Meetings with the ELG have been held periodically throughout the pre-planning period to inform the Proposed Scheme.

Term	Definition
EPS	European Protected Species (EPS) are those protected under the Conservation of Habitats and Species Regulations 2017 (as amended). Under this legislation it is an offence to deliberately capture, injure or kill any EPS, deliberately disturb an EPS, or to damage or destroy a breeding site or resting place. All UK Bat species are protected as European Protected Species.
EPSML	A European Protected Species Mitigation Licence (EPSML) is required from Natural England for any activities reasonably likely to affect an EPS in a manner that will result in an offence under the Conservation of Species and Habitats Regulations 2017 (as amended). The licence makes legal what would otherwise be an illegal activity, and (as of October 2022) also protects against offences under the Wildlife & Countryside Act.
Essential Environmental Mitigation	Areas of environmental mitigation, outside the Site Boundary, as part of the overall package of environmental mitigation as part of the Proposed Scheme, as shown on the 'Essential Environmental Mitigation' plan (Document reference: 2.11.00)
ES	An Environmental Statement (ES) summarises the findings of the EIA process and identifies likely significant effects arising from the Proposed Scheme and how they should be addressed.
EU	European Union

Term	Definition
Fission-fusion behaviour	A widely reported behaviour in mammals, including bats, where social groups frequently split into subgroups (fission) and then regroup (fusion). In bats, this results in frequent roost-switching.
Functional Loss	Behavioural changes resulting in the abandonment of a roost. Therefore, a loss of use rather than a physical loss through damage or destruction.
GLTA	Ground-Level Tree Assessments (GLTA) are generally the first stage of an assessment undertaken on a tree to identify if it is suitable to support roosting bats, and whether the Proposed Scheme is 'reasonably likely' to impact any bats which may roost within the tree. During a GLTA a tree is assessed to identify any potential roost features and classified as having either negligible, low, moderate, or high suitability to support roosting bats in line with best practice guidance (Collins, 2016). The assessment is undertaken from ground level using binoculars and a torch. The GLTA results inform recommendations for any further surveys if required.

Term	Definition
HPI	Habitats of Principal Importance (HPI) are habitats that were originally UK Biodiversity Action Plan (BAP) priority habitats. These covered a wide range of semi-natural habitat types and were identified as being the most threatened and requiring conservation action under the UKBAP. As a result of devolution, the UK BAP was succeeded by the 'UK Post-2010 Biodiversity Framework' in July 2012. The UK list of priority habitats, however, remains an important reference source and has been used to help draw up statutory lists of priority habitats in England, as required under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006 (England). HPI are listed and included within the Natural England Priority Habitat Inventory.

Term	Definition
HRA	A Habitats Regulations Assessment (HRA) is required if a proposed development or project may result in likely significant effects on the features of an internationally designated site (Special Protection Areas, Special Areas of Conservation or Ramsar site). This assessment is undertaken by the competent authority. A HRA consists of up to four stages; Stage 1, Screening; Stage 2, Appropriate Assessment; Stage 3, Derogation; Stage 4, Imperative Reasons of Overriding Public Interest (IROPI). Stage 1 relates to the screening of the project to identify if there is potential for likely significant effects on the qualifying features of the designated site in the absence of mitigation. Should likely significant effects be identified, Stage 2 must be undertaken. An Appropriate Assessment assesses the likely significant effects in the context of the conservation objectives and considers mitigation which may be required. Stage 3 is an assessment of alternative solutions and examines alternative ways of achieving the objectives of the scheme. The assessment includes how these alternatives may avoid or reduce adverse impacts on the integrity of the national site network site. Stage 4 is an assessment where no alternative solutions exist and where adverse impacts remain. It is an assessment of compensatory measures where, in the light of an assessment of Imperative Reasons of Overriding Public Interest (IROPI), it is deemed that the project or plan should proceed.

Term	Definition
I	In the context of this Environmental Statement, 'I' refers to Indirect ecological affects.
IEF	Important Ecological Features (IEF) in the context of the Proposed Scheme are features which are considered to be important given the location and / or scale of the Proposed Scheme. These may include individual species or groups of species which are assessed to be of 'Local' value or higher. The impacts of the Proposed Scheme on these IEFs are assessed within the ES.
JNCC	The Joint Nature Conservation Committee (JNCC) advises the UK Government on UK and International nature conservation. The JNCC holds information relating to designated sites within the UK including SACs, as well as protected species.
KPI	Key Performance Indicators (KPIs) are a set of targets and objectives used to measure the success of the Proposed Scheme. KPIs are used to measure the adherence to the Landscape Ecological Management Plan, ensuring that habitats are created / enhanced according to programme and are establishing as expected.
LEMP	Landscape Ecological Management Plan (LEMP) sets out site-specific procedures and processes for management for ensuring that habitats are created / enhanced according to programme and are establishing as expected.

Term	Definition
LNR	Local Nature Reserves (LNR) are statutory designated sites which are designated under Section 21 of the National Park and Access to the Countryside Act 1949. They are places of local interest for wildlife or geological features.
LPA	A Local Planning Authority (LPA) is the local governmental organisation that exercises planning functions within the local area.
LT	In the context of this Environmental Statement, LT refers to Long Term ecological affects.
LTP	The Local Transport Plan (LTP) details the plan for maintenance and improvement of local transport for a local authority. In the context of the Proposed Scheme, the relevant LTP is the Norfolk County Council Local Transport Plan 4 2021 – 2036.
MAGIC	The Multi-agency Geographic Information for the Countryside (MAGIC) service is a GIS service managed by Natural England which provides information relating to the natural environment. Information available on the MAGIC portal includes information from Natural England, Defra, the Environment Agency, Historic England, the Forestry Commission and Marine Management Organisation. The data includes information on designated sites, protected species and habitats, administrative geographies, and landscape designations.
MT	In the context of this ES, MT refers to Medium Term ecological affects.

Term	Definition
N/A	Not Applicable
Named Ecologist [on an EPS or other protected species licence]	The Named Ecologist is a professional ecological consultant who has satisfied Natural England that they have the relevant skills, knowledge and experience of the species concerned and is responsible for the undertaking and / or over-seeing the work undertaken in respect of the licensed species. The Named Ecologist has a responsibility for ensuring compliance with the licence.
NBAP	The Norfolk Biodiversity Action Plan (NBAP) is the local BAP relevant to the Proposed Scheme. It details the targets and actions relating to protected and endangered species and habitats within Norfolk in the form of species and habitat action plans.
NBIS	Norfolk Biodiversity Information Service (NBIS) is the Local Environmental Records Centre (LERC) relevant to the Proposed Scheme. The NBIS holds information on species, geodiversity, habitats, and protected sites for Norfolk.
NBSG	The Norfolk Barbastelle Study Group (NBSG) studies the distribution of barbastelle *Barbastellus barbastellus* across Norfolk.

Term	Definition
NCC CPA	Norfolk County Council (NCC) is the Local Planning Authority for the Proposed Scheme. The term 'NCC CPA,' County Planning Authority, is used within this chapter. NCC is also the applicant for the Proposed Scheme and referred to as 'NCC (the applicant)' within this chapter.
NE	Natural England (NE) is a public body which advises the government on the natural environment. It is responsible for the granting of European Protected Species licences and other protected species licences in England.
NERC Act	The Natural Environment and Rural Communities Act 2006 created NE and extended the duties of public bodies to ensure protections for biodiversity as initially set out in the Countryside and Rights of Way Act 2000. Under Section 40 of the NERC Act public authorities must *'in exercising its functions, have regard, so far as is consistent with the proper exercise of those functions, to the purpose of conserving biodiversity'.* The Environment Act 2021 makes changes to the NERC Act which updates the general duty to conserve biodiversity by adding a duty to not only conserve but also enhance biodiversity. Public authorities are also expected to produce reports on the action they have taken under this duty when designated by the Secretary of State. Section 41 of the Act details a list of habitats and species which are of principal importance for biodiversity.

Term	Definition
NH_3	NH_3 refers to the chemical name for ammonia, which is often used as a measure of emitted pollutants as part of air quality assessments.
NNR	National Nature Reserves (NNR) are designated under the National Parks and Access to the Countryside Act 1949 or the Wildlife and Countryside Act 1981 (as amended). NNRs are sites of national importance for wildlife and geological features within the UK.
NPPF	The National Planning Policy Framework (2023) (NPPF). The NPPF sets out the governments planning policies for England and how the policies should be applied. The most recent update of the NPPF was released in December 2023,.
NO_X	NO_X refers to the chemical name for Nitrogen Oxides, which is used as a measure of emitted pollutants as part of air quality assessments.
NVA	Night Vision Aids (NVA) are tools which are used to assist with night vision during bat surveys. These may include night vision cameras, infra-red cameras, and thermal imaging. NVAs are used to aid views of potential roost features and provide clarity on emergence points and bat counts. NVAs are also used on vantage point surveys to record bat flight paths, and associated behaviours that the bats exhibit.

Term	Definition
NWL	The Norwich Western Link Road (NWL) is the Proposed Scheme. The Proposed Scheme is a highway scheme linking the A1270 Broadland Northway from its junction with the A1067 Fakenham Road to the A47 trunk road near Honingham as described in Chapter 3 of this ES.
OBMS	The Outline Bat Mitigation Strategy (OBMS) has been produced to detail the mitigation and compensation, required to address the significant effects of the Proposed Scheme **(Appendix 11.6: Outline Bat Mitigation Strategy** (Document Reference: 3.11.06);).
OBMonS	The Outline Bat Monitoring Strategy (OBMonS) has been produced to detail the monitoring, required to address the significant effects of the Proposed Scheme (**Appendix 11.7: Outline Bat Monitoring Strategy** (Document Reference: 3.11.07);.
OCEMP	An Outline Construction Environmental Management Plan (OCEMP) has been produced which provides outline details of effective, site-specific procedures and mitigation measures to monitor and control environmental impacts during construction (**Appendix 3.1: Outline Construction Environmental Management Plan** (Document Reference: 3.03.01)).
OS	Ordnance Survey (OS) mapping data has been used in the production of this ES to identify the habitats and sites present along the Proposed Scheme, and to provide base mapping.

Term	Definition
P	In the context of this Environmental Statement, P refers to Permanent ecological affects.
PBRA	A preliminary bat roost assessment (PBRA) is an initial survey of a tree or building which comprises an external (and where possible internal) inspection in order to record potential roost features as well as any evidence of roosting bats. This will enable the tree or building to be categorised as negligible, low, moderate, or high based on best practice guidance (Collins, 2016). This assessment will be undertaken from ground level using binoculars and a torch.
PEA	A preliminary ecological appraisal (PEA) forms the first stage of an ecological assessment of a Site. A PEA generally consists of an ecological desk study, a habitat survey (Phase 1 or UK Habitat Classification) and an assessment of the suitability of the Site to support protected species.
PRF	Potential roost features (PRF) are features in trees and / or buildings which may provide roosting opportunities for bats. These features may provide points of access to the interior of trees or buildings.
PPG	Planning Practice Guidance (PPG) provides additional context and guidance to the NPPF. It is published by the UK Government Department for Communities and Local Government.

Term	Definition
ppn	Passes per night (ppn) is a measure of bat activity levels, recorded as the number of individual bat passes recorded on a static bat detector over the course of a night (usually defined as sunset to sunrise). Further details of what constitutes a pass is provided in **Appendix 11.4** (Document Reference: 3.11.04).
pSAC	Possible Special Areas of Conservation (pSACs) are site which were formally submitted to the UK Government for designation as an SAC (defined below) and initiated public consultation on the scientific case for designation, but the decision to designate is yet to be determined. The Regulations state that pSACs are to be considered afforded full protection until determined.
Red Line Boundary	The Red Line Boundary incorporates the Site Boundary, the Essential Environmental Mitigation, and No Work Zones not within the Site Boundary, as shown on the 'Red Line Boundary Plan' (Document reference: 2.02.00).
SAC	Special Areas of Conservation (SAC) are protected areas in the UK designated under the Conservation of Habitats and Species Regulations 2017 (as amended) in England and Wales. Under the Conservation of Habitats and Species Regulations, the UK Government designate a network of sites which conserve the habitats and species identified in Annexes I and II of the European Council Habitats Directive (92/43/EEC). Formerly part of Natura 2000, across Europe, they are now part of the UK's 'national site network'.

Term	Definition
SPI	Species of Principal Importance (SPI) are listed under Section 41 of the NERC Act. Species of Principal Importance are those first identified as priority species under the UK BAP.
Site Boundary	The areas within which all construction and operational activities for the Proposed Scheme will take place, including areas for temporary use during construction and No Work Zones within this boundary, but not including Essential Environmental Mitigation.
SSSI	Sites of Special Scientific Interest (SSSI) are designated under the Wildlife and Countryside Act 1981 (as amended) for the protection of habitats, species, and geological features.
ST	In the context of this Environmental Statement, ST refers to Short Term ecological effects.
'the Proposed Scheme'	This is a proposed new highway to link the A1270 Broadland Northway, from its junction with the A1067 Fakenham Road (to the north) to the A47 trunk road near Honingham (to the south).
T	In the context of this Environmental Statement, T refers to Temporary ecological effects.
TFL	Temporary Flightlines (TFLs) are structures put in place during construction to replace linear features that aided bats to move around the landscape and will be temporarily removed / disrupted. TFLs may take the form of planted hedgerows and tree lines, or the combined use of fencing and vegetation.

Term	Definition
TPO	Tree Preservation Orders (TPOs) are made by the LPA to protect specific trees, groups of trees or woodlands. A TPO prohibits the cutting down, uprooting, topping, lopping, wilful damage or wilful destruction of a protected tree. Trees are protected under TPOs as part of the Town and Country Planning Act 1990 (as amended) and the Town and Country Planning (Trees) Regulations 1999 (as amended).
UEA	University of East Anglia
VP	Vantage Point (VP) surveys are used by surveyors to record flightlines and emergence behaviours of bats. They are undertaken from a vantage point looking across the area to be surveyed, allowing a clear view of a large area. They are often useful to observe early commuting and foraging species.
WCA	Wildlife and Countryside Act 1981 (as amended) provides the main protections for animals, plants, and habitats within the UK. The legislation includes protections from killing and taking certain wild animals, restricts in the introduction of certain species, and affords protection to nationally designated sites.

11 Bat Ecology

11.1 Introduction

11.1.1 This chapter reports the outcome of the assessment of likely significant environmental effects arising from the Proposed Scheme on bat ecology. The wider likely significant effects arising from the Proposed Scheme on further biodiversity receptors are described in **Chapter 10: Biodiversity** (Document Reference: 3.10.00).

11.1.2 Impacts during the construction and operation phases of the Proposed Scheme are assessed. A full description of the Proposed Scheme is described in **Chapter 3: Description of the Proposed Scheme** (Document Reference: 3.03.00).

11.1.3 The Red Line Boundary is shown in **Figure 11.1 Appendix 11.10** (Document Reference: 3.11.10), which also shows the differentiation between the Site Boundary and Compensation Extent. To aid with reading this chapter, locations referenced by name within and surrounding the Red Line Boundary are shown on **Figure 11.2 Appendix 11.10** (Document Reference: 3.11.10).

11.1.4 This chapter:

- Summarises the legislative and policy framework;
- Describes consultation undertaken to date;
- Describes the methodology followed for the assessment;
- Describes and interprets the baseline recorded;
- Identifies the potential impacts of the Proposed Scheme;
- Details the design, mitigation and enhancement measures that have been proposed;
- Reports the assessment of the significant effects of the Proposed Scheme; and

- Details the monitoring that should be carried out for the Proposed Scheme.

Supporting Information

11.1.5 This chapter is supported by the following appendices within the Environmental Statement:

- **Appendix 11.1: 2019 Radio-Tracking Survey Report** (Document Reference: 3.11.01);
- **Appendix 11.2: 2021 Bat Radio-Tracking Survey Report** (Document Reference: 3.11.02);
- **Appendix 11.3: 2021 Bat Roost Survey Report** (Document Reference: 3.11.03);
- **Appendix 11.4: 2021 Bat Activity Report** (Document Reference: 3.11.04);
- **Appendix 11.5: 2022 Summer Bat Report** (Document Reference: 3.11.05);
- **Appendix 11.6: Outline Bat Mitigation Strategy** (Document Reference: 3.11.06);
- **Appendix 11.7: Outline Bat Monitoring Strategy** (Document Reference: 3.11.07);
- **Appendix 11.8: Bat In-Combination Assessment** (Document Reference: 3.11.08); and
- **Appendix 11.9: Temporary Storage Area Bat Survey Report** (Document Reference: 3.11.09). Full details of the study areas, survey methodologies, survey dates and guidance used for each survey are available in these appendices. A summary of survey results is provided within **Section 6** of this chapter; and
- **Appendix 11.10: Figures** (Document Reference: 3.11.10).

11.1.6 Full details of the mitigation and monitoring designed to avoid and / or reduce impacts from the Proposed Scheme on bat ecology are provided within **Appendix 11.6: Outline Bat Monitoring Strategy** (Document Reference: 3.11.06) and **Appendix 11.7: Outline Bat Monitoring Strategy (OBMonS)** (Document Reference: 3.11.07). These strategies set out the principles applied to the mitigation design and monitoring and signpost to the other application documents, which, alongside the obtaining of an EPSML, will secure the delivery of the mitigation measures. A high-level summary of the associated designs and responsibilities for delivering the mitigation and monitoring are provided within this chapter.

11.1.7 The Outline Bat Monitoring Strategy (OBMS) was used to inform the production of an Outline Construction Environmental Management Plan (OCEMP) **Chapter 3 Appendix 3.1**: **Outline Construction Environmental Management Plan** (Document Reference: 3.03.01). The purpose of the OCEMP is to manage environmental effects during the construction of the Proposed Scheme and to demonstrate compliance with environmental requirements, and which will inform the production of the final CEMP(s), which in turn will inform the application for an EPSML.

11.1.8 Effects on bat species from infrastructure projects can arise from direct and indirect impacts upon designated sites, habitats, or bat populations, and be of a temporary or permanent nature. Indirect effects can occur through pollution of air and water and via changes in lighting, noise, or hydrology. This chapter is therefore supported by information contained within the following chapters of the ES:

- **Chapter 5: Approach to EIA** (Document Reference: 3.05.00);
- **Chapter 6: Air Quality** (Document Reference: 3.06.00);
- **Chapter 7: Noise and Vibration** (Document Reference: 3.07.00);
- **Chapter 9: Landscape and Visual** (Document Reference: 3.08.00);
- **Chapter 10: Biodiversity** (Document Reference: 3.10.00); and

- **Chapter 12: Drainage and the Water Environment** (Document Reference: 3.12.00).

11.1.9 This chapter is supported by the following figures within **Appendix 11.10** (Document Reference: 3.11.10) of the ES:

- **Figure 11.1**: Red Line Boundary, Site Boundary and Compensation Extent
- **Figure 11.2**: Location References
- **Figure 11.3**: Designated Sites with bats included within designation
- **Figure 11.4**: Summer Automated Static Detector Locations
- **Figure 11.5**: Winter Automated Static Detector Locations
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11.2 Legislation and Planning Policy

Legislative Framework

11.2.1 Legislation associated with the protection of British bat species is detailed below. All further legislation associated with other ecological receptors is detailed within **Chapter 10: Biodiversity** (Document Reference: 3.10.00).

International

Habitats Directive (92/43/ EEC)

11.2.2 The Habitats Directive (92/43/EEC) sets the standard for nature conservation across the EU and enables its 27 Member States to work together within the same strong legislative framework in order to protect the most vulnerable species and habitat types across their entire natural range within the EU. Measures must be taken by Member States to maintain and restore, at favourable conservation status, natural habitats and species of wild fauna and flora of community interest. It is implemented within England and Wales through the Conservation of Habitats and Species Regulations 2017 (as amended; hereafter referred to as 'the Habitats Regulations') which identifies (amongst other measures) European Protected Species (EPS) relevant to the UK. See National legislation section for a brief summary of post-Brexit changes to the Habitats Regulations.

National

The Environment Act 2021

11.2.3 The Environment Act 2021 legislates the enhancing of the environment in the UK by introducing measures and targets for improving (amongst other measures) and / or preventing species decline. This Act introduces a new legally binding target on increasing British species abundance by 2030. The Act also sets out the framework for Biodiversity Net Gain.

11.2.4 The Environment Act 2021 makes changes to the NERC Act, which updates the general duty to conserve biodiversity by adding a duty to not only conserve but also enhance biodiversity.

Conservation of Habitats and Species Regulations 2017 (as amended)

11.2.5 The Habitats Directive is transposed into domestic law in England and Wales by means of the Conservation of Habitats and Species Regulations 2017 (as amended). They remain in force through the 'Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019', see below). The Regulations provide for the designation and protection of 'European Sites' in

England (now the 'national site network'), the protection of 'European Protected Species' (as listed on its Schedules 1 and 2, which currently mirror the relevant Habitats Directive annexes), and the adaptation of planning and other controls for the protection of the national site network.

11.2.6 In terms of the protection of EPS; all species of British bats are protected under regulation 43, making it illegal to:

- Deliberately capture, injure, or kill any such animal;
- Deliberately disturb wild animals of any such species; and / or
- Damage or destroy a breeding site or resting place of such an animal.

11.2.7 Under the Habitats Regulations, disturbance of protected animals includes, in particular, any disturbance which is likely to: (i) impair their ability to survive, breed or reproduce, or to rear or nurture their young or to hibernate or migrate; (ii) significantly affect the local distribution or abundance of the species in question.

11.2.8 Due to the high level of protection afforded to bats and their habitat, mitigation is governed by a strict licensing procedure administered by Natural England. Licensing is subject to three tests, as defined under the Habitats Regulations, these must be applied before granting permission for activities affecting bats. For permission to be granted the following criteria must be satisfied:

- The proposal is necessary for '*preserving public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment;'*
- '*There is no satisfactory alternative;'* and
- The proposals '*will not be detrimental to the maintenance of the population of the concerned at a favourable conservation status in their natural range.'*

Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019

11.2.9 The amendment made as a result of the United Kingdom's exit from the European Union (hereafter referred to as the '2019 Habitats Regulations'). Many of the changes to the Habitats Regulations arising from the 2019 Habitats Regulations relate to transferring powers from the European Commission to the appropriate authorities in England and Wales. The process for Habitats Regulations Assessment and the duties of Competent Authorities as defined in the Habitats Regulations remain largely unchanged. In addition, the 2019 Habitats Regulations brought about the following (non-exclusive list):

- The creation of the National Site Network, which comprises protected sites designated under the 2017 Habitats Regulations;
- The establishment of management requirements for the National Site Network; and
- Amendments to the Imperative Reasons of Overriding Public Interest (IROPI) test to replace the European Commission's former role.

Wildlife and Countryside Act 1981 (As Amended)

11.2.10 The Wildlife and Countryside Act 1981 (as amended; hereafter referred to as the 'WCA') is the principal mechanism for the legislative protection of wildlife in Great Britain. This legislation is the means by which the Bern Convention and (partially) the European Union Directives on the Conservation of Wild Birds (79/409/EEC) and Habitats Directive are implemented in the UK. The WCA includes provisions, amongst others, for the identification and designation of protected species.

11.2.11 These animals receive partial protection under the WCA, which makes it illegal (subject to certain exceptions) to:

- intentionally or recklessly disturb such animals while they occupy a place used for shelter or protection;

- intentionally or recklessly obstruct access to any structure or place which any such animal uses for shelter or protection;
- sell, offer, or expose for sale, or has in his possession or transports for the purpose of sale, any live or dead wild animal included in Schedule 5, or any part of, or anything derived from, such an animal; or
- publish or cause to be published any advertisement likely to be understood as conveying that he buys or sells, or intends to buy or sell, any of those things.

The Natural Environment and Rural Communities (NERC) Act 2006

11.2.12 The Natural Environment and Rural Communities Act (NERC Act) provides that any public body or statutory undertaker in England must have regard to the purpose of conservation of biological diversity in the exercise of their functions. The intention is to help ensure that biodiversity becomes an integral consideration in the development of policies and plans.

11.2.13 The Environment Act 2021 makes changes to the NERC Act which updates the general duty to conserve biodiversity by adding a duty to not only conserve but also enhance biodiversity. Public authorities are also expected to produce reports on the action they have taken under this duty when designated by the Secretary of State.

Policy Framework

11.2.14 Policy associated solely with protected sites, habitats and British bat species is detailed below. All further legislation associated with other ecological receptors is detailed within **Chapter 10: Biodiversity** (Document Reference: 3.10.00).

National

National Planning Policy Framework

11.2.15 The National Planning Policy Framework 2023 (hereafter referred to as the 'NPPF') sets out the Government's planning policies for England and it contains relevant policies specific to biodiversity and nature conservation (most notably section 15 from paragraph 180).

11.2.16 Moreover, it sets out provisions for biodiversity, including protected species, for which local planning authorities (LPAs) must have regard.

- Typically refusing development on land within or outside a Site of Special Scientific Interest that is likely to have an adverse effect on it (either individually or in combination with other developments). The only exception is where the benefits of the development in the location proposed clearly outweigh both its likely impact on the features of the site that make it of special scientific interest, and any broader impacts on the national network of SSSI; and
- Typically refusing development resulting in the loss or deterioration of irreplaceable habitats (such as ancient woodland and ancient or veteran trees) unless there are wholly exceptional reasons (for example, infrastructure projects (including nationally significant infrastructure projects, orders under the Transport and Works Act and hybrid bills), where the public benefit would clearly outweigh the loss or deterioration of habitat), and a suitable compensation strategy exists.

11.2.17 Planning Practice Guidance (PPG) has been published alongside the NPPF, and is regularly updated, to provide guidance on the implementation of the planning policies. It is also a matter of government policy that Ramsar Sites are considered in the HRA process as well as European Sites, with this set out in paragraph 181 of the National Planning Policy Framework.

11.2.18 The NPPF relates to conserving and enhancing the natural environment and requires local authorities in England to take measures to:

- protect and enhance sites of biodiversity;
- recognise the intrinsic character and beauty of the countryside, and the wider benefits from natural capital and ecosystem services;
- maintain the character of the undeveloped coast;
- minimise impacts and provide net gains for biodiversity;
- prevent new and existing development from contributing to, being put at unacceptable risk from, or being adversely affected by, unacceptable levels of soil, air, water or noise pollution or land instability; and
- remediate and mitigate despoiled, degraded, derelict, contaminated and unstable land, where appropriate.

Local

Greater Norwich Local Plan – Policy 3 – Environmental Protection and Enhancement

11.2.19 The Greater Norwich Local Plan was submitted to the Secretary of State for independent examination and was in early 2024.

11.2.20 Policy 3 requires development proposals to conserve and enhance the natural environment, including priority habitats, networks, and species, and deliver biodiversity net gain whenever possible. The protection and enhancement of the Green Infrastructure Network of Greater Norwich should be a consideration of all developments, and on-site green infrastructure should be provided wherever possible. Policy 3 also states the requirement for all housing development to mitigate impacts on sites protected under the Habitats Regulations

Norfolk County Council's Environmental Policy (2019)

11.2.21 Norfolk County Council adopted its Environmental Policy on 25 November 2019.

11.2.22 The policy aspires to encourage a thriving plant and wildlife community, make efficient and sustainable use of natural resources, enhance the beauty, heritage, and engagement with the natural environment, and enhance biosecurity.

11.2.23 The policy requires development to embed an 'environmental net gain' principle for development and maximise the benefits for people and the environment of features such as woodland. The natural environment should be protected, conserved, and recovered, and support for statutory and non-statutorily designated sites should be provided. The use and provision of green spaces should be encouraged, and creation measures such as tree planting should be prioritised.

Norfolk County Council: Local Transport Plan (LTP) 4 2021 – 2036

11.2.24 The Norfolk County Council LTP4 sets out Norfolk County Council's plans, policies and programmes on transport and transport infrastructure. The policy commits to assessing any potential loss of biodiversity as a result of the implementation of the transport strategy. This would be in order to seek to meet the objectives for biodiversity net gain as a condition of planning permission, in accordance with the Environment Act which received Royal Assent in 2021. The policy also commits to identifying opportunities for linear habitat creation along the active travel network.

Broadland District Council Environmental Strategy: Delivery Plan 2022 – 2024

11.2.25 Broadland District Council has, via the Environmental Strategy: Delivery Plan 2022 – 2024, committed to putting environmental considerations at the heart of delivery, and will work with the planning department to ensure all new developments consider environmental issues such as air quality and land quality.

Breckland District Council Local Plan

11.2.26 The Proposed Scheme is outside the Breckland district. However, the Proposed Scheme is within close proximity to the district and linked to the A47

DCO Scheme. The A47 Scheme is within the Breckland district. Therefore, this local plan has been included in this chapter.

11.2.27 The Breckland Plan aims to set a spatial vision and strategy for the district, with clear economic, social, and environmental objectives, and to meet the needs and aspirations of Breckland's residents. The Local Plan forms the development plan for the District.

River Wensum Restoration Strategy 2008 – 2027

11.2.28 The River Wensum Restoration Strategy has been developed by Natural England, in partnership with the Environment Agency and the Water Management Alliance, to restore the physical functioning of the river in order that it can sustain the wildlife and fisheries characteristic of a Norfolk chalk river. Working in partnership with landowners, the Norfolk Rivers Internal Drainage Board, fishing clubs and other interested groups, 12 kilometres of the River Wensum have so far been restored, including major restoration schemes at Bintree, Great Ryburgh Common, Ryburgh End, Swanton Morley, Tatterford and Sculthorpe.

11.3 Consultation

11.3.1 An Ecology Liaison Group (ELG) ran periodically through the pre-planning period, with the role of this group to provide, as part of the development of the Proposed Scheme, an in-depth local knowledge of ecological matters. **Table 11-1** includes an overview of consultation associated with bats, with all other biodiversity ELG liaison included within **Chapter 10: Biodiversity** (Document Reference: 3.10.00).

11.3.2 Consultation with statutory bodies, notably NE and the Environment Agency, was also undertaken through the lifetime of the pre-planning period. Key issues associated with bats discussed at each meeting are summarised in **Table 11-2**. Issues relating to wider biodiversity are included in **Chapter 10: Biodiversity** (Document Reference: 3.10.00). Consultation with the Environment Agency related to the water environment away from biodiversity is detailed in **chapter 12: Drainage and the Water Environment** (Document Reference: 3.12.00).

11.3.3 Further bat mitigation meetings held with NE are summarised in **Table 11-3**.

11.3.4 A bat advisory group (BAG), inclusive of independent bat experts, was established during 2021 to gain independent reviews and assessment of the following points:

- survey effort and approach;
- mitigation and compensation design; and
- sharing best practice, current research, and scheme examples of worked mitigation and compensation.

11.3.5 Individuals involved within the BAG (either historically or currently) have included representatives from Aspect Ecology, RSK Biocensus, Temple Group and Richard Green Ecology Ltd.

11.3.6 The outcomes of BAG reviews were taken into consideration during mitigation and compensation design and further development of the Proposed Scheme. The following aspects were discussed with the BAG:

- bat trapping and radio-tracking survey approach and analysis;
- green bridge and underpass design, associated landscaping, and its management;
- consideration of alternatives at each location;
- overview of landscaping approach;

- roosting mitigation and compensation;
- temporary flight line design and principles;
- noise monitoring; and
- development of the mitigation and monitoring strategies.

11.3.7 The BAG was also involved in key liaison meetings with Natural England, Norfolk Wildlife Trust, and third-party data holder / local researchers. Additionally, the BAG were involved in the review of this impact assessment and its conclusions.

11.3.8 Full access to third-party data that has been gathered for academic purposes (but is not in the public domain) was sought but not granted. A high-level summary of this third-party data has been received, and has been taken into consideration as part of this assessment. However, given the high-level nature of the information and absence of detailed information regarding roost locations, counts and the status of known roosts, the extent to which this could be used to inform the assessment has been limited.

11.3.9 At the time of writing, the research is continuing, delivered by a third-party working alongside and as part of the Norfolk Wildlife Trust, in parallel with the development of this chapter. Further high-level summaries have been confidentially shared, but cannot be included here.

Table 11-1 Consultation Summary Table – Ecology Liaison Group

Date of Consultation	Consultee	Summary of Key Topics and Key Outcomes
July 2019	ELG	**Key Topics relating to bats** • Outline of survey results and scope of surveys up to 2020 • Principal areas of interest regarding the Proposed Scheme. **Key Outcomes relating to bats** • Consultees committed to providing any lessons learned from previous road schemes to improve the ecological outcome of the Proposed Scheme. • Confirmation that all ecological survey work would be undertaken prior to planning being submitted.
October 2019	ELG	**Key Topics relating to bats** • Discussion with a plan of the Study Area to discuss opportunities and ideas for habitat creation and improvement. **Key Outcomes relating to bats** • Link to be circulated in regard to where the preferred route alignment is shown on an aerial base.
September 2020	ELG	**Key Topics relating to bats** • Outline of the Proposed Scheme survey baseline reports 2019 provided. Approaches to survey activities agreed with NE. • The Proposed Scheme 2020 survey scope presented including interim results and overview of the emerging ecological strategies for mitigation and compensation. Results of 2019 surveys for bats. **Key Outcomes relating to bats** • The Proposed Scheme 2020 survey scope – roosting enhancement / gain will provide instant roosting habitat for barbastelles. There also must be robust evidence to support the benefits of using bat boxes as mitigation. To be discussed in further detail in future meeting.

Date of Consultation	Consultee	Summary of Key Topics and Key Outcomes
January 2021	ELG	**Key Topics relating to bats** • Update in 2020 and 2021 ecological surveys. Bat survey findings overview – foraging, commuting, and roosting recorded. A range of species are present. Mitigation options being considered include woodland planting, woodland enhancement, bat underpasses / green bridges and bat boxes. Need to see a robust evidence base for the bridges, to ensure that they can deliver. • A47 corridor improvements – A47 North Tuddenham to Easton (A47 DCO) dualling. Barbastelle identified in the area. Cumulative effects must be considered with the Proposed Scheme (barbastelle and other bat species). • The applicant queried whether any attendees had information on landowners who might be interested in having environmental mitigation / improvement measures on their land. **Key Outcomes relating to bats** • Bat survey findings overview including the range of species present and mitigation options that are being considered. • Barbastelle identified in A47 DCO in regards to A47 corridor improvements.
July 2021	ELG	**Key Topics relating to bats** • 2020 Survey Results and 2021 Survey Progress. Provided brief overview of 2020 results for bats and surveys completed for bats, both roost and activity surveys. • Mitigation Strategy Update **Key Outcomes relating to bats** • Search to be widened in regard to literature evidencing barbastelle use of bat boxes and green bridges, drawing on grey literature from other UK-based schemes / projects where appropriate. • Meeting to be organised between Norwich Bat Group and WSP radio-tracking lead prior to August radio-tracking session to discuss survey strategy.

Date of Consultation	Consultee	Summary of Key Topics and Key Outcomes
July 2022	ELG	**Key Topics relating to bats** • Bats surveys completed between 2019-21 with some ongoing surveys in 2022. The surveys in 2019 were undertaken to inform the optioneering process. • The 2021 survey area was refined to inform mitigation measures and the Environmental Statement (ES). • The main data for bat radio-tracking was collected in 2021. Barbastelle core and peripheral foraging areas and the route refinement. **Key Outcomes relating to bats** • WSP to provide summary regarding bat survey and assessment methodology and how baseline, population size estimate is established. **Post-Meeting Note** • Assessment methods and baseline interpretation is included within this chapter.
September 2022	ELG	**Key Topics relating to bats** • Surveys to inform the planning application are continuing on site. • Scheme overview – Norfolk Wildlife Trust raised a concern that a hop over design suggested for the bat crossing in the northern section, instead of a bridge and that unevidenced mitigation is being put forward. WSP stated that national bat experts are part of the team considering the design, and that decisions will be evidenced appropriately. • Ecological Mitigation and Enhancements –the Applicant provided an overview for protected species including bats. **Key Outcomes relating to bats** • There will be continued dialogue with NE regarding mitigation with a core focus on species including bats. • Compilation of mitigation into outline Ecological Mitigation Strategy and CEMP. **Post-Meeting Note** • Due to a number of factors discussed in Appendix 11.6 (Document Reference: 3.11.06), a bat green bridge is now included as part of Embedded Mitigation within the Northern Woodlands, not a landscape treatment designed for bat crossing.

Table 11-2 Consultation Summary Table – Natural England (NE) and the Environment Agency (EA)

Date of consultation	Consultee	Summary of Key Topics and Key Outcomes
June 2016	NE	**Key Topics relating to bats** • River Wensum Special Area of Conservation / Site of Special Scientific Interest – potential impacts • Extensive bat activity (8-9 species) within the Wensum corridor, including barbastelle commuting routes. Barbastelle roosting in woodland at Weston Golf Club flying down the valley, plus activity all around the wider area. Clear need for extensive bat surveys to inform the Proposed Scheme design, as well as mitigation, which should consider minimising impact at the river crossing and artificial lighting. **Key Outcomes relating to bats** • It was agreed that crossing points of the River Wensum will be considered at design stage NE confirmed that no specific assent process would be required for ecological surveys. Surveys of the River Wensum are required and opportunities to maximise enhancements should be considered.
March 2019	NE & The EA	**Key Topics relating to bats** • Bat survey methodology – format of ecological survey data – agreement that there would be an emphasis on using larger numbers of automated detectors for bat activity surveys. **Key Outcomes relating to bats** • Mitigation – agreement was put into practice for surveying. • Emphasis on using static detectors rather than thermal imaging surveys for two hours after sunset, as initial results indicated that barbastelle were active through the night from dusk to dawn. Static detectors would produce more useful data to allow a better assessment of the potential impacts of the Proposed Scheme on local bat populations and activity.
June 2019	NE & The EA	**Key Topics relating to bats** • Ecology survey programme and results of ecology surveys to date – WSP updated that ecology surveys were ongoing with extensive bat surveys and radio-tracking being carried out across the Study Area as the main focus. The surveys have allowed identification of additional bat roosts and Barbastelle have been detected across the Study Area. • Ecology scope for the next stage of work – beyond the preferred route announcement, surveys would include ground level tree assessments and tree climbing.

Date of consultation	Consultee	Summary of Key Topics and Key Outcomes
August 2019	NE & The EA	**Key Topics relating to bats** • Bat survey methodology, scope of ecological surveys correspondence (18.10.2018, 13.06.2019, and 01.08.2019): Bats would include ground level tree assessments and tree climbing. A better understanding of scope and work required once preferred route alignment is known. • Issue of the Baseline Ecology Surveys 2019-2020 report – There would be an emphasis on using static detectors rather than thermal imaging surveys for two hours after sunset. **Key Outcomes relating to bats** • All surveys have now been completed and a note on data validity of surveys is to be circulated to NE for comment.
November 2019	NE & The EA	**Key Topics relating to bats** • Ecological impact of preferred route considering barbastelle, to consider that there are a number of roosts in the Study Area. Bat boxes are proposed to be installed. Wildlife crossing Structures for bats to cross the Proposed Scheme. Approximate underpass dimensions 4m x 4m largely on same flight path. Potential locations include the Broadway and the woodland complex at the north end of the route. • Survey scope to be issued to NE for 2020 surveys. **Post-Meeting Note** • 2020 survey scope was included and completed.
January 2020	NE	Bat technical note detailing survey areas provided to Natural England.
September 2020	NE	**Key Topics relating to bats** • Hibernation Surveys – bats coming to and leaving hibernation surveys. The road separates the main colony from the area bats are hibernating. Hibernation roosts are at a distance from Site Boundary.
December 2020	NE	**Key Topics relating to bats** • Update to a bat technical note that had previously been issued to Natural England.

Date of consultation	Consultee	Summary of Key Topics and Key Outcomes
March 2021	NE	**Key Topics relating to bats** • The Proposed Scheme Programme Update – environmental surveys ongoing. Planning for summer surveys, including bat radio-tracking. • Bat Update – radio-tracking licence submitted: discussions ongoing with NE and third parties regarding survey partitioning. Further (non-radio-tracking) surveys also programmed. Technical Note on scoping of trees and structures will be distributed to NE. Mitigation design planning ongoing; informed by latest evidence both on site and in wider literature. • Baseline Data: bats – Continual process of data collection from 2019 through 2021. 2021 surveys include gap filling tree climbing, Ground Level Tree Assessments (GLTA), vantage point (VP) and automated detector surveys. Hibernation and winter activity surveys completed Q1 2021. Radio-tracking scheduled for May / Aug 2021. Habitats Regulations Assessment (HRA): update – third party comments on barbastelle populations and their status.

Date of consultation	Consultee	Summary of Key Topics and Key Outcomes
April 2021	NE	**Key Topics relating to bats** • Bat Radio-tracking Surveys – Scoping Meeting and following correspondence to discuss (2021 catching and radio-tracking surveys). • Survey approach, timeframes, data sharing and maximum counts. This results in specific conditions being added to the licence document not restricted to but including the following: o AC03. A maximum of sixteen (16) trapping events may be carried out under this licence (see notes). o AC06. A maximum of one mist net may be used per woodland block where a combination of mist net and harp traps are utilised. o AC09. Trapping / capture and radio-tagging of bats, in trapping locations as recorded in the 2021 Radio-Tracking Access and Trapping Location plan included in the method statement, must be timed as follows: - 16 May 2021 to 20 May 2021 (am) in trapping locations 1-8, starting in locations 1-5 - 9 June 2021 to 10 June 2021 in trapping locations 5-8 - 11 June 2021 to 14 June 2021 in trapping locations 1-8 - 7 August 2021 to 8 August 2021 in trapping locations 5-8 - 9 August 2021 to 14 August 2021 in trapping locations 1-8 o AC10. Trapping activities must be timed to avoid 15 June 2021 to 31 July 2021. o AC11. Trapping must be suspended if heavily pregnant bats are captured under this licence. o AC13. The licensee may attach radio tags to a maximum of 20 Barbastelle bats, 3 Daubenton's bats, 4 Natterer's bats plus a maximum of 5 bats of each of other species that may be captured. o AC14. All bats radio-tagged must have rings fitted and no bat may be radio-tagged more than once during 2021. o AC20. Tagging and ringing data must be shared with NE to maximise the potential information which can be gained from the research projects in combination. Ring identification numbers, species, sex, breeding status & trapping location must be shared with the other nearby licensees within 24 hours of tagging (with equivalent condition on the local researcher's licence).

Date of consultation	Consultee	Summary of Key Topics and Key Outcomes
April 2021	NE	**Key topics relating to bats** ○ AN02. Where possible, radio-tag frequencies should be shared with other nearby licensees within 24 hours of tagging in order to maximise the potential information which can be gained from the research projects in combination (with equivalent condition on the local researcher's licence). ○ AN03. Where possible, the licensee should liaise with (a local researcher – name redacted) to share roost location data to ensure acoustic lures are not used withing 50 metres of any known bat roost. Written confirmation of such liaison shall be submitted to (name redacted) NE within 3 working days (with equivalent condition on the local researcher's licence). Following further liaison after the initial survey session, dates were altered and June catching dates were agreed. In addition, following completion of the June surveys the number of barbastelles that could be tagged in August was increased to 15 individuals.

Date of consultation	Consultee	Summary of Key Topics and Key Outcomes
October 2021	NE	**Key Topics relating to bats** • Bat mitigation feedback- loss of roosting and foraging resource feedback (25.10.2021). o Bat boxes and tree veteranisation are proposed to replace lost roost resource. o NE are unclear what bat activity is currently present within many of these woodlands and whether they lack suitable roosting opportunities and therefore whether veteranisation of trees within these woodlands will provide an adequate replacement. o NE expect a precautionary approach to be taken with respect to the size and design of such structures. The dimensions provided for the underpasses and green bridges for the Norwich Western Link are below those generally recommended as a minimum. NE will need evidence that the dimensions as proposed will be appropriate to adequately mitigate the potential impacts. o More detail required about how planting and landscaping is being designed to guide bats to crossing structures where the bats appear to currently be using multiple flightpaths to cross the proposed route alignment. Many structures are also identified as being mixed-use and the structures will need to be of sufficient width and appropriate design to accommodate the necessary planting. Structure design and location must also consider the full bat assemblage present. o Where landscaping is proposed to facilitate bat movement across the road, we will need evidence of its effectiveness, in order to consider these as compensation for loss of connectivity. o NE will need specifications and evidence of their effectiveness for the species concerned before we can consider the appropriateness of this mitigation during construction and establishment. o The approach will need to carefully consider the time lag between the impacts and effective establishment of compensation measures. This may need to be supported by survey data showing any alternative connectivity that will ensure bat populations will not be severed from key commuting / foraging resources. o NE would expect the numbers of roost features to be created to consider the significance of the roosts to be lost, and also to account for loss of potential roost resource e.g. trees with Potential Roost Features (PRF). o Further information with regards to bat movement through the landscape to comment upon the suitability of the locations and extent of proposed woodland and hedgerow creation is required. NE are unable to provide comment as to whether the proposed habitat features to be created, or the ratio of woodland and hedgerow replacement to that lost is appropriate until we have the detailed impact assessment. o Any compensation measures to enhance existing woodland will need to identify how they provide benefits for each impacted bat species as the species will have differing requirements.

Date of consultation	Consultee	Summary of Key Topics and Key Outcomes
October 2021	NE	• Bat mitigation – construction and operational impacts and compensation feedback. ○ The construction footprint and operational impacts of the road upon retained and newly created roosts / habitats need to be taken into account when considering the impact of the Proposed Scheme, and thus the requirement for mitigation / compensation. We note that current impacts appear to have been considered within 25 m of the Site Boundary, but it is unclear as to whether the construction or operational impacts may extend beyond that buffer. **Key Outcomes relating to bats** • NE require thorough understanding of the impacts of the Proposed Scheme upon barbastelle, given the rarity of the species and the precautionary approach that we will need to take in order to conclude that any loss or degradation of maternity roost resource will not impact upon the Favourable Conservation Status. **Post-Meeting Note** • The width of the green bridges is justified within the Outline Bat Mitigation Strategy (OBMS). The OBMS includes a narrative and justification on design for each of the green bridges and underpasses, this is inclusive of an evidence base and relevant research, where possible. • Where possible, relevant research and evidence is provided within the OBMS. • Connectivity across the Proposed Scheme and into the wider landscape has been included within the OBMS, over both the construction and operation.

Table 11-3 Consultation Summary Table – Norwich Western Link – Bat Mitigation Workshop

Date of consultation	Consultee	Summary of Key Topics and Key Outcomes
May 2022	NE	**Key Topics** • Scheme introduction – proposed dual carriageway between A47 and Broadland Northway to the west of Norwich. Initial part of the A1270 Broadland Northway but taken out in 2005. Missing link in Norwich orbital. • Overview of baseline – recap of survey methods, special extent, and timings. Overview of collated baseline data at scheme level. Baseline completed 2019 to 2021. 2019 undertaken to inform route optioneering. 2020-2021 methodology and survey area refined. 2019 to 2021 data relating to the 2020 preferred option detailed within bat activity, bat roost and radio-tracking reports. Standalone bat chapter. • Surveys completed – roost surveys, activity surveys (VP, summer automated, winter automated) and radio-tracking (2019, 2021). • VP surveys – reference to barbastelle satellite roost. Why are they not a maternity roost when several bats are found? How important that roost is if we don't have enough data on the maternity roost? Precautionary approach taken. Further survey might reduce uncertainty regarding precautionary approach to roost mitigation. • NE requested all roosts of each species to be displayed on specific figures. It also suggested inclusion of third-party data to enable interpretation at landscape scale. • Automated detector surveys – summer data, winter data. Hotspot maps have been produced and peaks in activity have been extracted for presentation to aid interpretation. • Radio-tracking – barbastelle, myotis sp., brown long-eared. • Scheme refinement and mitigation principles. • Ecology Surveys – Correspondence reviewing the 2021 baseline survey reports. Correspondence was received regarding the completed baseline bat surveys, reported in Bat Roost Survey Report 2021 (authored by WSP dated February 2022), Bat Radio-Tracking Survey Report 2021 (authored by WSP dated February 2022), Bat Activity Report 2021 (authored by WSP dated April 2022). • Ecology Mitigation – Correspondence reviewing the 2021 baseline survey reports (16/05/2022) and planned mitigation meeting to discuss (17/05/2022). Correspondence was received regarding the OBMS 2022 (authored by WSP dated April 2022). **Key Outcomes** • Species map may be accelerated. Species maps were provided as part of the draft EPSML application. • Continue with the conservation around mitigation. • Provision of further information including species-specific roosts figures and ghost licence issued date to be confirmed. Official response to the correspondence provided. Issue date to be determined.

Date of consultation	Consultee	Summary of Key Topics and Key Outcomes
November 2022	NE	**Key Topics** • Review of actions and outcomes from the May 2022 bat mitigation meeting. • Overview of Responses to Previous NE comments. • Interpretation of specific results / third party data inclusion. • Overview of Impacts and Key Mitigation Designs, inclusive of designs to cover roost resource loss, severance and fragmentation, habitat loss and degradation. • Discussion on scoping out Paston Great Barn Special Area of Conservation (SAC) from the HRA **Key Outcomes** • The Applicant / WSP to refer to (and amend to) draft licence only going forward, instead of previously noted ghost licence. • WSP to ensure 2022 report is included in draft licence submission. • WSP (in conjunction with Ferrovial Construction (the Principal Contractor)) to provide specific numbers of woodland loss and width of road. • WSP to consider green bridge design and inclusion of access track for ES and draft licence • The Applicant to outline decision-making on the C11 green bridge (Morton green bridge). • Age of planting in landscape strategy to be confirmed. • The Applicant to respond in detail on potential for pre-construction planting. • Agreement log to be updated and distributed.
January 2023	NE	**Key Topics** Submission of a draft European Protected Species Mitigation Licence (EPSML) application via Natural England's Pre-Submission Screening process. The licence documents assessed the impacts, and detailed the mitigation, compensation, and monitoring designs for the Proposed Scheme.
February 2023	NE	**Key Topics** • Site visit to view locations of key mitigation features and hold discussions on the design of green bridges. **Key Outcomes** Provision of detail of the heights of crossing structures in relation to recorded bat flight heights. NE requested further information regarding the survey effort, impact assessment and mitigation and compensation design. Liaison is ongoing.

Date of consultation	Consultee	Summary of Key Topics and Key Outcomes
December 2023	NE	**Key Topics** Resubmission of a draft European Protected Species Mitigation Licence (EPSML) application via Natural England's Pre-Submission Screening process. The licence documents assessed the impacts, and detailed the mitigation, compensation, and monitoring designs for the Proposed Scheme.

11.4 Scope of the Assessment

11.4.1 Scoping determines the issues to be covered in an EcIA, in accordance with the Chartered Institute of Ecology and Environmental Management (CIEEM) EcIA Guidelines (CIEEM, 2018).

11.4.2 The scope of this assessment has been established through a stepwise scoping process, including the production of an Environmental Impact Assessment Scoping Report in 2020 (WSP, 2020) and the receipt of a Scoping Opinion Decision Letter in 2022, and further through route refinement. Further information can be found in **Chapter 5: Approach to EIA** (Document Reference: 3.05.00). Additionally, a route refinement exercise was completed. Further information is also provided within **Chapter 4: Reasonable Alternatives Considered** (Document Reference: 3.04.00).

11.4.3 This section provides an update to the scope of the assessment and updates the evidence base for scoping out issues following further iterative assessment. A single element identified for bats has been scoped out and is not considered to give rise to likely significant effects as result of the Proposed Scheme.

11.4.4 The Paston Great Barns SAC is located 26 kilometres north-east from the Site Boundary, which is within the 30-kilometre Study Area for SACs which include bats within the site designation. The location of this SAC is shown on **Figure 11.3 Appendix 11.10** (Document Reference: 3.11.10). This 30-kilometre Study Area is based upon the DMRB Guidance (Standards for Highways, 2020). The justification for why this element has been scoped out from likely significant effects is provided within **Table 11-4**.

11.4.5 Further details are also provided within the Environmental Impact Assessment Scoping Report and the receipt of a Scoping Opinion Decision Letter in 2022. Further information can be found in **Chapter 5: Approach to EIA** (Environmental Impact Assessment) (Document Reference: 3.05.00) and **Habitats Regulations Assessment (HRA)** (Document Reference: 4.03.00).

11.4.6 All other elements scoped out in **Chapter 10: Biodiversity** (Document Reference: 3.10.00), have also been scoped out for not having a likely significant effect as a result of the Proposed Scheme for bats. Details of these elements are provided within **Table 10-3** in **Chapter 10: Biodiversity** (Document Reference: 3.10.00).

Table 11-4 Elements Scoped out of the Assessment

Ecological issue	Scoping as per the Proposed Scheme Environmental Impact Assessment Scoping Report (WSP, 2020)	Update scoping for this chapter	Justification
Paston Great Barn SAC	Scoped out	Scoped out	No likely significant effects are expected due to the following: **Construction and Operation Phases** Degradation through pollution and a reduction in air quality: substantial distance and no hydrological links between the SAC sites and the Site Boundary. Disturbance: the Proposed Scheme is not expected to increase visitor pressure on these features once operational. Distribution of supporting habitat: Due to the distance of the Site Boundary, habitat loss is not considered to be supporting habitat for the population of barbastelles present within the SAC.

Elements scoped into the assessment

Construction Phases

11.4.7 The following potential construction phase impacts, considered to have the potential to give rise to likely significant effects, have been included within this assessment:

a. mortality and / or injury of bats as habitats are cleared;
b. loss of roosts / the roost resource through direct removal, or indirect habitat change causing abandonment;
c. disturbance to bats through noise and vibration, or lighting;
d. severance / fragmentation of ecological networks (including commuting routes) between roosts / the roost resource and foraging areas; and
e. removal and degradation of foraging habitats within and adjacent to the Site Boundary, reducing its overall carrying capacity.

Operational Phase

11.4.8 The following operational phase impacts, considered to have the potential to give rise to likely significant effects, have been included within this assessment:

a. Accidental mortality and / or injury of bats due to road collisions;
b. Longer-term fragmentation between bat populations resulting in genetic severance; and
c. Alteration and / or degradation of habitats supporting bats as a result of emissions to air, the accidental release of hazardous materials, increased noise and vibration, and additional lighting.

11.5 Assessment Methodology

Overview

11.5.1 All areas of land required temporarily or permanently for the construction and operational activities of the Proposed Scheme are contained within the Red Line Boundary as illustrated **Chapter 3: Description of the Proposed Scheme** (Document Reference: 3.03.00). The Red Line Boundary includes:

- Site Boundary: the areas within which the main engineering works (structures, carriageway, drainage, earthworks etc) will be undertaken;
- areas for temporary use during construction, which are also within the Site Boundary; and
- the remaining areas include areas for Environmental Enhancement and Mitigation.

11.5.2 The baseline conditions and the assessment in this chapter are based on the Site Boundary for the Proposed Scheme (see **Figure 11.1, Appendix 11.10** (Document Reference: 3.11.10)). The requirement for a construction temporary use area was identified during 2022 (storage area referred to in **Appendix 11.9** (Document Reference: 3.11.09)), therefore the baseline conditions described in this chapter do not include a full assessment of this area. It was included within the wider survey area for the trapping and radiotracking surveys (**Appendix 11.2: 2021 Bat Radio-Tracking Survey Report** (Document Reference: 3.11.02)). Therefore, this area is partially covered. Given this, assumptions have been made regarding the baseline conditions of this construction temporary use area, and mitigation is embedded into the design of the Proposed Scheme to account for this.

11.5.3 The impact assessment, however, includes an assessment of impacts in relation to all parts of the Red Line Boundary including all land required temporarily during construction and land required permanently for environmental enhancement and mitigation.

11.5.4 This report details the analysis and assessment of potentially significant effects predicted to arise from the Proposed Scheme on the following categories of ecological feature:

- Statutory designated sites allocated for bats; and
- Bat species.

11.5.5 The methodology for the assessment of impacts on bats is compliant with the Chartered Institute of Ecology and Environmental Management (CIEEM) EcIA

Guidelines (CIEEM, 2018), and therefore differs from the overarching EIA methodology as defined in **Chapter 5: Approach to EIA** (Document Reference: 3.05.00). It is specific to biodiversity and has been carried out pursuant to relevant legislation, planning policy and guidance, and in accordance with NE Standing Advice, Bats: advice for making planning decisions (Natural England, 2022b).

11.5.6 The assessment presents the potential effects arising from the construction and operational phases of the Proposed Scheme per Important Ecological Features (as defined below). This is first be undertaken considering Embedded Mitigation measures only, as described in **Chapter 3: Description of Scheme** (Document Reference: 3.03.00). The assessment per IEF then presents the Additional Mitigation measures relevant to the IEF, and the potential residual effects arising from the construction and operation phases of the Proposed Scheme considering these measures. This process is undertaken for each IEF in turn, rather than working through each stage of the assessment for all features.

11.5.7 A significant effect upon bats is defined as an effect that could have an impact upon the structure, form, function, and conservation status of the species population. The relative importance of ecological features are valued against a geographic frame of reference (CIEEM, 2018; Reason, P.F. and Wray, S. (2023)).

11.5.8 Mitigation has been developed on an iterative basis, with the mitigation hierarchy followed; preference is first given to avoiding effects, then reducing effects through targeted mitigation where necessary. Where residual effects remain after application of targeted Mitigation Measures, compensation has then been considered.

Establishment of Baseline Conditions

Desk Study

11.5.9 The following sources were consulted to collate historical ecological records, including bats, within the relevant Study Areas of the Proposed Scheme:

- Ordnance Survey (OS) website (Ordnance Survey);
- Online photographic resources, including publicly accessible aerial photography;
- The Multi-agency Geographic Information for the Countryside (MAGIC) service;
- Joint Nature Conservation Committee (JNCC); and
- Norfolk Biodiversity Information Service (NBIS).

11.5.10 The desk study included:

- Collation of relevant existing biological records from third parties including the local biological records centre;
- Collation and creation of plans showing both statutory and non-statutory designated sites and associated citations; and
- Review of relevant policy documentations and extant permissions relevant to bats and the Proposed Scheme.

11.5.11 The Study Area for desk study data for each bat species extended to between 2 kilometres and 6 kilometres from the Site Boundary, based on the Core Sustenance Zone (CSZ) for that species using CSZ provided within Bat Surveys for Professional Ecologists: Good Practice Guidelines (Collins, 2016). Details of the Study Area for each bat species is provided in **Table 11-5**.

11.5.12 Requests to NBIS for biological records for non-statutory designated sites (County Wildlife Sites (CWS)) in addition to protected and notable species were made in 2018, 2021 and 2022. The latest review of biological records considered records from the last ten years from the date of the request (2012 – 2022). The request included non-statutory designated sites (CWS) within 2 kilometres of the Study Area which were reviewed for any sites that included bats within their designation. The request also included all verified bat records within 2 kilometres of the Site Boundary in 2018 and 2021, extended to 5 kilometres for all bat species and 6 kilometres for barbastelle in 2022. A

search of recent planning applications (submitted within the past 5 years) was undertaken using local planning authority planning portals (Breckland Council, South Norfolk, and Broadland District Council) to identify developments within 6 kilometres of the Site Boundary that have had or are likely to have a negative impact on bats. A distance of 6 kilometres was used as this is the maximum CSZ of British bat species (BCT, 2016). This list was then refined based on each species, with records collated where roosts fall within the CSZ of that species, as detailed in **Table 11-5**.

11.5.13 Potentially sensitive ecological receptors for bat populations were identified within Study Areas of between 2 kilometres and 30 kilometres from the Site Boundary (see **Table 11-5**). Search distances were determined with regard to the following guidelines:

- Design Manual for Roads and Bridges (Standards For Highways, 2022));
- Bat Surveys for Professional Ecologists: Good Practice Guidelines (Collins, 2016);
- CIEEM Guidelines for Preliminary Ecological Appraisal (CIEEM, 2017);
- CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1. CIEEM. Winchester (CIEEM, 2018);
- BMG Version: January 2004 (Mitchell-Jones A.J, 2004); and
- BMG (Reason, P.F. and Wray, S., 2023).

11.5.14 The Study Areas have also been informed by emerging design information and in response to work completed by other technical specialists. This is a consistent approach with impacts considered by other chapters such as **Chapter 6: Air Quality** (Document Reference: 3.06.00) in relation to air quality impacts on designated sites and important habitats.

11.5.15 Freely available NE datasets available via MAGIC were used to search for National Site Network sites (Special Areas of Conservation (SAC)) within 30kilometres of the Site Boundary, and National Statutory Designated Sites (Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR) and Local Nature Reserves (LNR) within 5 kilometres of the Site Boundary that included bats within the designations. Additionally, a search was completed of any areas that NE is considering for SSSI notification (Natural England, 2022a). It should be noted that inclusion on the list is not a commitment by NE to designate any such areas.

11.5.16 NE datasets available via MAGIC were also reviewed for European Protected Species (EPS) licences granted for bats within 6 kilometres of the Site Boundary. This list was then refined based on each Study Area for each species, as detailed in **Table 11-5**.

11.5.17 As part of the desk study, a review of bat survey data published online was completed to gather historic data on roosts and foraging areas. The review included data generated to inform the planning process, and data generated during post-construction monitoring of the Northern Distributor Road (now referred to as Broadland Northway). Specific attention was given to data generated through A1270 Broadland Northway radio-tracking surveys because this spans the survey area for the Proposed Scheme and includes roost records for rarer species including barbastelle and *Myotis*. The following reports were reviewed to extract third party roost data:

- BSG (2010). Norwich Northern Distributor Road; Bat Activity and Radio-tracking Surveys 2009;
- BSG Ecology on Behalf of Equinor (2022). Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects Environmental Statement. Chapter 20: Onshore Ecology and Ornithology;
- Greena Ecological Consultancy (2013a). Report on a bat radio-tracking study of Barbastelle bats; Norwich Northern Distributor Road, 2013 (25th July 2013);

- Greena Ecological Consultancy (2013b). Report on a bat radio-tracking study of Barbastelle bats; Norwich Northern Distributor Road, 2012 (V1A 23 January 2013);
- Highways England (2021a) A47 North Tuddenham to Easton Dualling, Volume 6 6.1 Environmental Statement, Chapter 8 – Biodiversity;
- Highways England (2021b) A47 North Tuddenham to Easton Dualling, Volume 6 6.3 Environmental Statement Appendices, Appendix 8.11 – Bat hibernation report;
- Highways England (2021c) A47 North Tuddenham to Easton Dualling, Volume 6 6.3 Environmental Statement Appendices, Appendix 8.12 – Bat Survey report;
- Mott MacDonald on behalf of NCC (2014) Norwich Northern Distributor Road; 6.1 Environmental Statement: Volume I
- Mott MacDonald on behalf of NCC (2019a) Norwich Northern Distributor Road; Post Construction Monitoring – Bats;
- Mott MacDonald on behalf of NCC (2019b) Norwich Northern Distributor Road; Post Construction Monitoring – Hibernating Bats;
- Mott MacDonald on behalf of NCC (2020a) Norwich Northern Distributor Road; Post Construction Barbastelle Bat radio-tracking monitoring report: Year 1 2018;
- Mott MacDonald on behalf of NCC (2020b) Norwich Northern Distributor Road; Post Construction Monitoring: Year Two, Bat Mitigation Monitoring;
- Mott Macdonald on behalf of NCC (2021a). NDR Ecological Post-Construction Monitoring: Year Three, Bat Mitigation Monitoring;
- Mott Macdonald on behalf of NCC (2021b). NDR Ecological Post-Construction Monitoring: Year Three, Bat Hibernation Monitoring;

- Mott Macdonald on behalf of NCC (2023). NDR Ecological Post-Construction Monitoring: Year Five, Bat Mitigation Monitoring;
- Norfolk Wildlife Services on behalf of Vattenfall (2019a). Norfolk Boreas Offshore Wind Farm, Appendix 22.4 Bat Activity Survey Reports, Environmental Statement, Volume 3.
- Norfolk Wildlife Services on behalf of Vattenfall (2019b). Norfolk Boreas Offshore Wind Farm, Appendix 22.5 Bat Emergence Re-entry Survey Reports, Environmental Statement, Volume 3.
- Norfolk Dinosaur Park Ltd (2021) Proposed Expansion Roarr! Dinosaur Adventure, Lenwade, Norfolk. Environmental Statement;
- Royal Haskoning DHV on behalf of Vattenfall (2019). Norfolk Boreas Offshore Wind Farm, Chapter 22 Onshore Ecology, Environmental Statement, Volume 1.
- Thomson Ecology (2018a) Hornsea Project Three Offshore Wind Farm, Environmental Statement: Volume 3, Chapter 3 – Ecology and Nature Conservation;
- Thomson Ecology (2018b) Hornsea Project Three Offshore Wind Farm, Environmental Statement: Volume 6, Annex 3.8 – Bat Surveys;
- Wild Frontier Ecology on behalf of Equinor (2022a). Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects, Environmental Statement, Volume 3, Appendix 20.3 – Bat Activity Survey Report;
- Wild Frontier Ecology on behalf of Equinor (2022b). Sheringham Shoal and Dudgeon Offshore Wind Farm Extension Projects, Environmental Statement, Volume 3, Appendix 20.10 – Bat (Roosting) Survey Report; and
- Wild Wings Ecology (2019). Norwich Northern Distributor Road: Post-construction Barbastelle Bat Radio-tracking Monitoring Report, Norwich.

Table 11-5 Study Areas per Receptor

Receptor	Study Area	Data Source
National Site Network sites (SACs) designated for bats	30km	Natural England and JNCC
National Statutory Designated Sites (SSSIs, NNRs, LNRs) with bats included within designations	5km	Natural England
Non-statutory Designated Sites (CWSs) with bats included within designations	2km	NBIS
Common pipistrelle (*Pipistrellus pipistrellus*)	2km	Natural England, NBIS and Brecklands, South Norfolk, and Broadland District Councils
Brown long-eared bat (*Plecotus auritus*), soprano pipistrelle (*Pipistrellus pygmaeus*), Nathusius' pipistrelle (*Pipistrellus nathusii*) and Leisler's bat (*Nyctalus leisleri*)	3km	Natural England, NBIS and Brecklands, South Norfolk, and Broadland District Councils
Myotis sp, noctule and serotine *(Eptesicus serotinus)*	4km	Natural England, NBIS and Breckland, South Norfolk, and Broadland District Councils
Barbastelle	6km	Natural England, NBIS, and Brecklands, South Norfolk, and Broadland District Councils

Field Surveys

11.5.18 Following the Preliminary Ecological Appraisal (PEA) which identified suitable habitats present on land required for the Proposed Scheme for roosting, commuting and foraging bats, detailed bat surveys for bats were undertaken. All methods and associated survey coverage are detailed within the associated baseline report. The approach, survey areas and methods have all been subjects of discussion during liaison with Natural England. The surveys completed are listed in **Table 11-6**.

11.5.19 The Site Boundary plus associated buffers was considered an appropriate approach to defining Survey Areas, as the Site Boundary centres on the Proposed Schemes impacts during construction and operation. This approach was modified where appropriate, and these deviations are detailed within **Table 11-6.** The Compensation Extent section of the Red Line Boundary was not subject to detailed baseline assessments given these areas will be subject to habitat creation and improvements only.

11.5.20 Field surveys were undertaken between 2019 and 2023 during different stages of the Proposed Scheme design. Due to this, different Survey Areas may have been applied to the same survey type (i.e. GLTA) across different years of surveys. Where multiple survey areas were used, only the latest extent is listed within **Table 11-6**, for which full survey coverage is achieved using the combined dataset.

11.5.21 Gap filling exercises were then completed in 2022 and 2023 to ensure that all areas within the Survey Areas were subject to complete survey effort, with the exception of existing roads that are being used for access at Ringland Road and Blackbreck Lane.

Table 11-6 Bat Surveys Undertaken

Survey	Years Undertaken	Guidance and Methodologies	Survey Area	Baseline Report
Ground-level tree assessments	2019, 2020, 2022 and 2023.	Collins, 2016. Bat Surveys for Professional Ecologists: Good Practice Guidelines, 3rd edition, Bat Conservation Trust (BCT).	Within and up to 25m from the Site Boundary	Appendix 11.3 (Document Reference: 3.11.03), Appendix 11.5 (Document Reference: 3.11.05) and Appendix 11.9 (Document Reference: 3.11.09)
Preliminary Bat Roost Assessments – structures	2020	Collins, 2016	Within and up to 100m from the Site Boundary	Appendix 11.3 (Document Reference: 3.11.03)
Climbing tree inspection surveys.	2019, 2020, 2021 and 2022	Collins, 2016	Within and up to 25m from the Site Boundary	Appendix 11.3 (Document Reference: 3.11.03) and Appendix 11.5 (Document Reference: 3.11.05)
Emergence / Re-entry Surveys – Trees	2020, 2021 and 2022	Collins, 2016	Within and up to 25m from the Site Boundary	Appendix 11.3 (Document Reference: 3.11.03) and Appendix 11.5 (Document Reference: 3.11.05)
Emergence / Re-entry Surveys – Buildings	2021	Collins, 2016	Within and up to 100m from the Site Boundary	Appendix 11.3 (Document Reference: 3.11.03)
Automated Static Detector (ASD) Surveys – Summer	2019, 2020, 2021 and 2022	Collins, 2016	Site Boundary and connected habitats at risk of severance from the Proposed Scheme. A number of additional locations were also surveyed outside of the Site Boundary to enable a comparison of bat activity levels across the broader landscape. Locations of ASD deployment locations for summer months are shown on **Figure 11.4, Appendix 11.10 (Document Reference: 3.11.10)**.	Appendix 11.4 (Document Reference: 3.11.04) and Appendix 11.5 (Document Reference: 3.11.05)

Survey	Years Undertaken	Guidance and Methodologies	Survey Area	Baseline Report
ASD Surveys – Winter	2020-2021	Collins, 2016	Site Boundary and connected habitats at risk of severance from the Proposed Scheme. Locations of ASD deployment locations for summer months are shown on **Figure 11.5, Appendix 11.10 (Document Reference: 3.11.10)**.	Appendix 11.4 (Document Reference: 3.11.04) and Appendix 11.5 (Document Reference: 3.11.05)
Vantage Point Surveys	2019, 2020, 2021 and 2022	Berthinussen, A., & Altringham, J. (2015). Development Of A Cost Effective Method For Monitoring The Effectiveness Of Mitigation For Bats Crossing Linear Transport Infrastructure. University of Leeds / Defra.	Twelve targeted VP survey locations within the Site Boundary locations which had been identified as supporting higher levels of bat activity recorded by automated bat detectors, located in areas of habitat that could be used for foraging and / or commuting, with associated connective habitats. Location of VP survey locations are shown on **Figure 11.6, Appendix 11.10 (Document Reference: 3.11.10)**.	Appendix 11.4 (Document Reference: 3.11.04) and Appendix 11.5 (Document Reference: 3.11.05)
Bat hibernation surveys – trees	2019 and 2021	Collins, 2016	Within and up to 25m from the Site Boundary	Appendix 11.3 (Document Reference: 3.11.03)
Bat hibernation surveys – structures	2020	Collins, 2016	Within and up to 500m from the Site Boundary	Appendix 11.3 (Document Reference: 3.11.03)
Dusk / Dawn Bat-Tracking Surveys	2020	Collins, 2016	Northern Woodlands, woodland south of Ringland Lane, woodlands along the Broadway and Telegraph Hill, and Foxburrow Plantation	Appendix 11.3 (Document Reference: 3.11.03)
Bat trapping surveys	2019 and 2021	Collins, 2016	Locations based on the ecology of the target species, known roost locations and habitats with suitability to the support these species	Appendix 11.1 (Document Reference: 3.11.01) and Appendix 11.2 (Document Reference: 3.11.02)

Survey	Years Undertaken	Guidance and Methodologies	Survey Area	Baseline Report
Bat radio-tracking surveys	2019 and 2021	Collins, 2016 Kenward, R. (2000). *A manual for wildlife radio-tagging.* London: Academic Press White, G. & Garrott, R. (1990). *Analysis of wildlife radio-tracking data.* Sandiego: Academic Press	This covers approximately 5.5km east to west and 6km north and south, encompassing the Site Boundary, which is linked to suitable habitats and land subject to access agreements. However, search radii were on occasion extended where possible, on publicly accessible land.	Appendix 11.1 (Document Reference: 3.11.01) and Appendix 11.2 (Document Reference: 3.11.02)

11.5.22 During 2023, a gap-filling exercise was completed in the form of a GLTA in respect of a temporary storage area that had been added to the Site Boundary. The GLTA was undertaken in May 2023 to gather preliminary roost suitability data on woodland and hedgerow trees adjacent to these storage areas. The survey approach and methods utilised are detailed within **Appendix 11.9: Temporary Storage Area Bat Survey Report** (Document Reference: 3.11.09).

11.5.23 Surveys have been completed over a five-year period to inform this assessment. The approach and Survey Areas have been periodically assessed, and modifications of approach taken where the need was identified. During this period, ongoing surveys have provided information regarding the baseline conditions within the Site Boundary and validation exercises have occurred. These approaches are in line with survey guidelines and have been discussed with Natural England, the ELG and BAG, to ensure a robust and rounded approach was taken. It is considered that sufficient survey effort has been completed to inform this assessment and associated mitigation and compensation requirements. Additionally, with the continuing reassessment of data and baseline conditions, it is considered that the survey effort timeframes is in line with the Chartered Institute of Ecology and Environmental Management's Advice Note on Lifespan of Ecological Reports and Surveys (CIEEM, 2019).

11.5.24 Since completion of the survey effort a 4th edition of the bat survey guidelines has been released (Collins, 2023). The majority of the survey effort detailed within this assessment is beyond the new requirements set out in the 4th edition of the guidelines. Therefore, it is considered that the baseline conditions remain in line with current survey guidelines.

Guidance and Data

11.5.25 The following guidance documents and data sources have been used during the preparation of this Chapter:

a. Guidelines on Preliminary Ecological Appraisal (CIEEM, 2017);

b. Guidelines on Ecological Impact Assessment (CIEEM, 2018);

c. Advice Note on Lifespan of Ecological Reports and Surveys (CIEEM, 2019);

d. Guidelines for Accessing, Sharing and Using Biodiversity Data in the UK (CIEEM, 2020);

e. BMG Version: January 2004 (Mitchell-Jones A.J, 2004);

f. UK BMG (Reason, P.F. and Wray, S., 2023);

g. Conference of European Directors of Roads (CEDR) Transnational Road Research Programme Call 2013: Roads and Wildlife: Fumbling in the dark – effectiveness of bat mitigation measures on roads. Bat mitigation measures on roads – a guideline (CEDR, 2016) ;

h. Natural England Standing Advice, Bats: advice for making planning decisions. Published 14 January 2022 (Natural England, 2022b); and

i. Office of the Deputy Prime Minister (ODPM) Circular 06/05; Defra Circular 01/2005: Biodiversity and Geological Conservation – Statutory Obligations and Their Impact Within The Planning System (ODPM, 2005).

Assessment of significance

11.5.26 The assessment of potentially significant effects as a result of the Proposed Scheme has considered both the construction and operation phases. The construction phase includes enabling works, demolition, earthworks, and construction activities as set out in **Chapter 3: Description of the Proposed Scheme** (Document Reference: 3.03.00).

Value of an Ecological Feature – Bat Species

11.5.27 The importance and value of an ecological feature is determined on a geographical scale as follows (updated to incorporate the BMG (Reason, P.F. and Wray, S. (2023)):

a. International (within Europe);

b. National (relating to the UK, specifically England);

c. Regional (South-eastern/East Anglia to The Wash);

d. County (Norfolk);

e. District (Broadland);

f. Local (features that are of importance at a Site level but are not valued at District or higher); and

g. Site.

11.5.28 The geographical scale of importance for statutory and non-statutory designated sites is assigned based on their designation. For example, European Sites and Ramsar Sites are considered of 'International Importance,' because they are designated on the basis of supporting habitats and / or species which are of importance for nature conservation at an international / European level. Sites of Special Scientific Interest and National Nature Reserves are considered to be of 'National Importance' because they are designated for supporting habitats, species, and other features of importance for nature conservation at a UK level.

11.5.29 The geographical scale of importance for bat species is assigned with reference to any designations or policy provisions that apply. For example, Species of Principal Importance (SPI), as identified by the provisions of Section 41 of the NERC Act, are considered of particular importance to the conservation of biodiversity in England. That is not to say that all SPI are considered of 'National Importance.' Populations of such species that form an appreciable part of the English resource, would however be considered of 'National Importance.'

11.5.30 A similar approach applies to bat species in the absence of the policies detailed above. For example, British bat species are recognised as a priority for nature conservation at a European (International) level, by way of their identification as an EPS under the Habitats Regulations. Very large populations that make up an appreciable proportion of the European

population might rightly be identified as of 'International Importance.' Smaller populations that are not exceptional in the locality they occur and do not contribute particularly to the maintenance of wider populations would be of lesser importance. This approach is in line with the BMG (Mitchell-Jones A.J, 2004; Reason, P.F. and Wray, S., 2023), which have been taken into account when evaluating the importance of an individual bat species and the overall bat assemblage within this ES.

11.5.31 To inform this assessment, the guidelines identify each bat species as being: 'widespread,' 'widespread in many geographies, but not as abundant in all,' 'rarer or restricted distribution' or 'rarest Annex II species and very rare,' geographically split into different areas of the UK. This BMG geographic scale underpins the assessment of the importance of roosts, commuting routes and foraging areas, and of the overall assemblage of bats present within the Site Boundary, in terms of the assessment geographic scale (e.g. International, National, Regional etc.) detailed above. Whilst it provides a basis for assessment, a degree of professional judgement, explicitly supported by sound ecological evidence, is also taken into consideration.

11.5.32 The following factors are taken into account when defining geographical scale of importance for bat species:

a. Legal protection;

b. Planning policies;

c. Distribution, including relative to the Proposed Scheme;

d. Conservation status (i.e. is the habitat / species common and widespread, or rare with a highly localised distribution); and

e. Historical trends.

11.5.33 The BMG (Reason, P.F. and Wray, S., 2023) sets out the rarity category of bat species, differences in abundance and distribution within each country boundary. The rarity for each species South-eastern / East Anglia to The

Wash has been extracted from the guidelines and is detailed within **Table 11-7**.

Table 11-7 Bat Mitigation Guidelines Species Rarity Categories

Rarity Category	**Species included for South-eastern / East Anglia to The Wash**
Widespread all geographies	Common pipistrelle, soprano pipistrelle, brown long-eared bat
Widespread in many geographies, but not as abundant in all	Daubenton's bat, Natterer's bat, noctule
Rarer or restricted distribution	Whiskered bat, Brandt's bat, serotine, Leisler's bat, Nathusius' pipistrelle
Rarest Annex II species and very rare	barbastelle

11.5.34 The approach to determining the nature conservation value and / or sensitivity of each ecological feature is outlined in **Table 11-8**. Species listed within **Table 11-8** have been selected for presence within the county. If not within the geographic range of or the behavioural attributes for a specific species, these have not been listed. For example, greater horseshoes are not present within Norfolk and are therefore not listed.

Table 11-8 Value of Ecological Features

Value	Description
International or European Value	National Site Network sites with bat species cited as reasons for designation including Sites of Community Importance (SCIs); SACs; candidate or possible SACs (cSACs or pSACs). These sites will be considered as part of the national site network on land and at sea, including both the inshore and offshore marine areas in the UK. Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Resident, or regularly occurring, populations of species which may be considered at an International or European level where: • the loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; or • the population forms a critical part of a wider population at this scale; or • the species is at a critical phase of its life cycle at this scale. Bat populations functionally linked to populations for which an SAC is designated may be assessed as up to international value. In making this assessment, linkages between the known roosts and habitats, as well as the designation criteria above would be taken in account

Value	Description
National Value	Designated sites with bat species cited as reasons for designation including: SSSIs; and NNRs. Areas which meet the published selection criteria e.g. JNCC (1998) for those sites listed above but which are not themselves designated as such. Areas of key / priority habitats identified in the UK Biodiversity Action Plan (BAP), including those published in accordance with section 41 of the Natural Environment and Rural Communities Act (2006) and those considered to be of principal importance for the conservation of biodiversity. Areas of Ancient Woodland i.e. woodland listed within the Ancient Woodland Inventory. Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where: • the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or • the population forms a critical part of a wider population at this scale; or • the species is at a critical phase of its life cycle at this scale. Sites within or functionally linked to SSSIs of national importance or sites meeting SSSI guidelines, may or may not have that value of importance (Reason, P.F. and Wray, S., 2023). Linkages between the known roosts and habitats, as well as the bullet points listed above would need to be taken into consideration to information this valuation level.

Value	Description
Regional Value	Within the BMGs, rarity category examples of roosts which may meet the County / Regional value include (Reason, P.F. and Wray, S. (2023)): • hibernation sites for barbastelle within the Rarest Annex II species and very rare conservation status category; • autumn swarming sites for species for Brandt's bat, whiskered bat, Daubenton's bat, Natterer's bat, Alcathoe bat, serotine, and barbastelle; and • maternity sites Alcathoe bat, serotine, Leisler's bat Nathusius' pipistrelle and barbastelle.

Value	Description
County Value	Designated sites including: CWSs; and LNRs designated in the county or unitary authority area context. Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Areas of key / priority habitats identified in the Local BAP; and areas of habitat identified in the appropriate Natural Area Profile (or equivalent). Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where: • the loss of these populations would adversely affect the conservation status or distribution of the species across the County; or • the population forms a critical part of a wider population; or • the species is at a critical phase of its life cycle. The examples of roosts which meet the BMG's valuation assessment for County value is detailed within the Regional value above. In addition, examples of roosts which may meet the District / County value, under the South-eastern / East Anglia to The Wash rarity category include (Reason, P.F. and Wray, S., 2023): • hibernation sites for common pipistrelle, soprano pipistrelle, brown long-eared bat, Brandt's bat, whiskered bat, Daubenton's bat, Natterer's bat, noctule serotine, Leisler's bat Nathusius' pipistrelle; and • autumn swarming sites for brown long-eared bat.

Value	Description
District Value	The examples of roosts which meet the BMGs' valuation assessment for District / County value is detailed within the County value above. In addition, examples of roosts which may meet the district value, include (Reason, P.F. and Wray, S. (2023)) larger transitional roosts for: • Brandt's bat, whiskered bat, Daubenton's bat, Natterer's bat, noctule; • Alcathoe bat, serotine, Leisler's bat Nathusius' pipistrelle; and • barbastelle and Alcathoe bat. The examples of roosts which meet the BMGs' valuation assessment for Site / Local / District value include mating sites, hibernation roosts supporting only a small number of bats and non-breeding day roosts under the following conservation status categories: • Alcathoe bat, serotine, Leisler's bat, Nathusius' pipistrelle; and • , barbastelle and Alcathoe bat.
Local Value	Designated sites including: LNRs designated in the local context. Trees that are protected by Tree Preservation Orders (TPOs). Areas of habitat; or populations / communities of species considered to appreciably enrich the habitat resource within the local context (such as veteran trees), including features of value for migration, dispersal, or genetic exchange. The examples of roosts which meet the BMG's valuation assessment for Site Local / District value is detailed within the regional value above.

Value	Description
Site Value	The examples of roosts which meet the BMGs valuation assessment for Site / Local / District value is detailed within the district value above. In addition, examples of roosts which may meet the site value, category include (Reason, P.F. and Wray, S., 2023) feeding perches, night-roosts, very small occasional / transitional / opportunistic roosts, non-breeding day roosts, mating site (excluding individual trees and larger swarming sites), and small numbers of hibernating bats under the following conservation status categories: • Common pipistrelle, soprano pipistrelle, brown long-eared bat; and • Brandt's bat, whiskered bat, Daubenton's bat, Natterer's bat, noctule.
Negligible Value	Features or habitats that do not have an appreciable ecological value.

11.5.35 For each of the BMGs' evaluations detailed within **Table 11-8** above, several influencing factors need to be taken in to account while undertaking the evaluation, inclusive of the number of bats using the roost relative to the species (Reason, P.F. and Wray, S., 2023). Other factors that influence the evaluation of a roost include, but are not limited to:

- roosting preferences and typical roost sizes for a given species or roost type;
- species behaviours, such as the tendency to have satellite roosts associated with the main maternity site, or larger male gatherings seen in some species; and
- differences in tree roosting behaviour, for example the nature and longevity of features selected as roost sites.

Important Ecological Features

11.5.36 According to the BMG, the defining of "Important Ecological Features" (IEF) should be based on professional judgement. Species can be assessed as individual IEFs, or grouped where impacts are likely to be similar, or where it is difficult to adequately differentiate between species without invasive techniques.

11.5.37 For the purposes of this assessment, individual bat species have been assessed separately where possible, with the exception of *Myotis* species, as these cannot be fully distinguished from each other based on echolocation recordings.

11.5.38 Ecological features relating to bats of Local value or higher are assessed as being IEFs that could experience significant effects.

Significant Effects on Important Ecological Features in Relation to Bats

11.5.39 Once the evaluation of ecological features was undertaken, the assessment identified potential biophysical changes arising from proposed activities during the construction and operation of the Proposed Scheme that may affect features. At this stage, the assessment considered effects on features accounting for the Proposed Scheme design including Embedded Mitigation measures.

11.5.40 A 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives status for IEFs. Significant effects on each IEF are assessed as either positive or negative. Where an effect is neither positive nor negative, this is assessed as 'not significant.'

11.5.41 The relative importance of a significant effect is determined based on the extent to which the integrity or conservation status of an IEF is compromised (i.e. the magnitude of the effect) and the value of the IEF, defined at the geographical scale. Characteristics referenced (as required) when describing ecological impacts and effects are listed in **Table 11-9**.

Table 11-9 Characteristics of Ecological Impacts and Effects

Characteristic	Description
Positive or Negative	Determined according to whether the change is in accordance with nature conservation objectives and policy
Extent	The area over which the effect may be experienced (Reason, P.F. and Wray, S., 2023)
Magnitude	Size, amount of intensity and volume of the impact. Quantified and in absolute terms, where possible
Duration	Permanent (P) or Temporary (T) in ecological terms. Where differing timescales are determined in relation to the life-cycle of the feature, these are defined
Timing and Frequency	The number of times an activity occurs will influence the resulting effect.
Reversibility	An irreversible effect is one from which recovery is not possible within a reasonable timescale or there is no reasonable chance of action being taken to reverse it. A reversible effect is one from which spontaneous recovery is possible or which may be counteracted by mitigation.

11.5.42 In the context of the EcIA, the significance of an effect is assessed as either significant (an appreciable effect on the structure, form, function, and conservation status) or not significant (no or negligible effect on structure, form, function, and conservation status), having regard to the factors in **Table 11-9**.

11.5.43 **Table 11-10** sets out how an effect is classified in other ES chapters and how it relates to the CIEEM EcIA Guidelines and BMG based on professional judgement.

Table 11-10 EIA Classification Terminology and How it Relates to CIEEM ECIA Guidelines

EIA Significance of an Effect as detailed in Chapter 5: Approach to EIA (Document Reference: 3.05.00).	Related CIEEM Assessment Significance of an Effect Terminology used in this chapter	Description
Very Large Significant (beneficial)	Significant (positive)	Positive effect on conservation status of an Important Ecological Feature at a county, national or international scale
Moderate Significant (beneficial)	Significant (positive)	Positive effect on conservation status, structure, form or function of an Important Ecological Feature at a District or Local scale
Not significant or Slight to Neutral	Not Significant	No or negligible effect on structure, form, function, or conservation status of an Important Ecological Feature
Moderate Significant (adverse)	Significant (negative)	Negative effect on structure, form, function or conservation status of an Important Ecological Feature at a District or Local scale
Very Large Significant (adverse)	Significant (negative)	Negative effect on structure, form, function, or conservation status an Important Ecological Feature at a County, National or International scale

11.5.44 Effect significance is assessed according to the CIEEM EcIA guidance, which states that:

"Significance is a concept related to the weight that should be attached to effects when decisions are made. For the purpose of EcIA, 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features' (explained in Chapter 4) or for biodiversity in general. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national / local nature conservation policy) or more wide-ranging (enhancement of biodiversity). Effects can be considered significant at a wide range of scales from international to local" (paragraph 5.25, page 24).

11.5.45 Ecological effects are described in relation to the geographic scale at which they are regarded as significant, from international to local. It should be noted that in line with the guidance issued by CIEEM, an impact which has been considered as significant in ecological terms is the same as significant in EIA terms.

11.5.46 The CIEEM method is relevant to the assessment of ecological effects associated with both the construction and operational stages of the Proposed Scheme.

Assessment assumptions and limitations

11.5.47 General assumptions and limitations are detailed within **Chapter 10: Biodiversity** (Document Reference: 3.10.00). The assumptions and limitations which apply to this bat species assessment are outlined below.

11.5.48 For each assumption or limitation, an explanation of the impact on the bat assessment has been provided in addition to a description of any corrective actions that have been taken to adjust for any limitations.

11.5.49 The assessment of effects assumes that all Embedded and Additional Mitigation measures will be successfully implemented and will function as designed / expected.

11.5.50 Where a limitation is relevant to the evaluation of baseline conditions, this is detailed within **Section 6** of this chapter.

11.5.51 Any limitations to the collection of baseline survey data are provided in Appendices 11.1 to 11.5. The considerable level of baseline data collection is considered sufficient to inform the ES.

Desk Study Data

11.5.52 Desk study data provided by biological records centres, publicly available licence documents and planning documents within the public domain, are subject to spatial coverage of biodiversity recording schemes. A detailed review of publicly available desk-study data has been completed alongside the standard desk study approach. However, it is known that there is third-party data that has not been made available. For this reason, the absence of desk study records for a particular species has not been taken to indicate species absence. In all instances, the presence or absence of a particular species in desk study records has been used alongside survey data and the known or anticipated species distributions to infer whether these species may be present. Where doubt exists, a precautionary assessment has been taken by assuming a species' presence in suitable habitat.

Field Survey Data

11.5.53 Survey data is typically valid for approximately 18 months to 3 years according to guidance from the CIEEM regarding the validity of survey data. This is dependent on the species being surveyed. Bat surveys were completed between 2018 and 2023.

11.5.54 The identification of a barbastelle roost within Rose Carr necessitated the identification of a new refinement option to the Preferred Route that would minimise and avoid direct impacts on bats and their habitats. The confirmation of the realignment of the Proposed Scheme was completed in July 2022. Additional survey work was undertaken in 2022 to update the baseline conditions in response to the realignment.

11.5.55 Data gathered during the suite of bat surveys completed to inform the Proposed Scheme in combination with the results of other biodiversity surveys (for example habitat survey data) is sufficient to evaluate baseline conditions and underpin the assessment of likely impacts.

Design

11.5.56 No detail on decommissioning has been prepared and the operational lifespan of the Proposed Scheme is not yet known. In the absence of detail on decommissioning, impacts of this stage are assumed to be similar to that of construction and no separate consideration of decommissioning effects has been presented.

11.5.57 At this stage, activities associated with construction activity have been based on a realistic scenario as informed by industry standards .

Assessment

11.5.58 Maintenance activities associated with the operational of the Proposed Scheme are not included within the impact assessment, as sufficient detail is not available to conclude an assessment. It is assumed that all maintenance activities would be assessed in their own right as permitted development assessments.

11.6 Baseline Conditions

Existing baseline

Barbastelle

Desk Study

11.6.1 The locations of roosts identified from desk study records are presented on **Figure 11.7, Appendix 11.10** (Document Reference: 3.11.10) .

11.6.2 A review of publicly available historic radio-tracking data was undertaken, as detailed in **Section 11.5.18**, which returned 84 records of barbastelle roosts within the 6-kilometre Study Area (the CSZ of barbastelle (BCT 2023)), which are summarised below:

- 58 roost records were located within habitats surrounding Roarr! Dinosaur Park, Royal Norwich Golf Course and Scotchwood Hills;
- 21 roost records were located to the north of the Site Boundary, within woodland habitats surrounding Felthorpe;
- one roost was recorded 2.8 kilometres west of the Site Boundary within Hockering Wood SSSI;
- three records were located to the east of the Site Boundary; one 300 metres east in Gravelpit Plantation, one 1.2 kilometres south-east in Snake Wood, and one 2.7 kilometres south-east in Costessey; and
- one record 5.8 kilometres north-west of the Site Boundary in a woodland near Sparham.

11.6.3 The closest record to the Site Boundary, identified through the review of historic radio-tracking data, was a day roost (male bat tracked to tree) identified in 2009 that is located 170 metres east of the Site Boundary, at Fakenham Road. This roost was assessed within the A1270 Broadland Northway (formerly referred to as the Northern Distributor Road) ES as likely to be subject to disturbance resulting from the A1270 Broadland Northway. No post-construction monitoring data is available to confirm the current status of this roost.

11.6.4 An open letter to the Applicant, published as part of the A47 DCO planning comments, detailed data from a collaboration study between Wild Wings, University of East Anglia (UEA) and Norfolk Barbastelle Study Group (NSBG), which included details of woodlands used by maternity colonies of barbastelles, and woodlands supporting other barbastelle roosts (Pett, 2021). Woodlands identified as supporting maternity roosts that are present within and / or immediately adjacent to the Site Boundary, included Primrose Grove, the Nursery Woodland, Rose Carr, and Long Plantation. Woodlands supporting maternity roosts outside the Site Boundary include Scotchwood Hills, Hardingham Hills, woodlands within Royal Norwich Golf Course and

woodlands within Roarr! Dinosaur Park. Other barbastelle roosting habitat included Gravelpit Plantation and Juniper Valley.

11.6.5 The historic data search also included reviewing radio-tracking survey data collected for the A1270 Broadland Northway from 2009, 2012, 2013 and 2018 to identify foraging areas for barbastelle. In 2013, a female barbastelle caught in Marriott's Way was using habitat from the River Wensum up to Felthorpe for foraging. This area partially falls within the Site Boundary (Greena Ecology, 2013), and provides evidence of connectivity between the Site Boundary and Felthorpe area.

11.6.6 The open letter with summary data included from a collaboration study between Wild Wings, UEA and NBSG identified foraging habitat within woodland blocks within the Site Boundary at the Northern Woodlands and Gravelpit Plantation. Foraging habitats outside of woodlands within the Site Boundary include the River Wensum, and arable fields between the Northern Woodlands and the River Wensum. Additional foraging habitat was also identified outside the Site Boundary, at the Wensum Valley Golf Course, Royal Norwich Golf Course, Felthorpe and fields surrounding Scotchwood Hills.

11.6.7 The open letter also identified 'main commuting routes' for barbastelle; those that are within or immediately adjacent to the Site Boundary are summarised below:

- along the edge of Rose Carr then across an open field toward Primrose Grove within the Site Boundary;
- across an open field from Primrose Grove to the River Wensum within the Site Boundary;
- leading from Rose Carr to the River Wensum, within the Site Boundary at the location of the River Wensum Viaduct;
- along the River Wensum that crosses the Site Boundary, at the location of the River Wensum Viaduct; and

- leading from an unnamed woodland north of Rose Carr, which leads across the river Wensum before crossing Fakenham Road. The mapped location of the where the flightline crosses Fakenham Road is at the approximate location of VP11.

11.6.8 NBIS returned 109 records of barbastelle within the 6 kilometres Study Area from the last ten years. Of these, 16 were roost records or assumed roost records (in the absence of details). These roost records are summarised below:

- eight roost records were associated with surveys completed for the A1270 Broadland Northway, with the roosts located within habitats surrounding Royal Norwich Golf Club, Roarr! Dinosaur Park, Snake Wood and Felthorpe. These points directly corresponded with radio-tracking data from the historic data search detailed in **paragraph 11.6.1**;
- two roost records 2.4 kilometres west of the Site Boundary, both relating to a building in Hockering. An assumed day roost as the records details a count of two barbastelle on one survey, and one barbastelle on a second survey;
- three assumed roost records located 1.2 kilometres north of the Site Boundary, along Marriott's Way. No details were provided on the record type; however, a count of one female was returned for two of the points, and of one male for one of the points. Due to the presence of abundance counts with sex, roosts have been assumed;
- one hibernation roost in a barn recorded 2.4 kilometres west of the Site Boundary Scheme near Hockering Wood SSSI; and
- two roost records; an unspecified roost type (minimum 2 adult females) and a maternity roost data point provided fall within the Site Boundary at the Northern woodland. However, the record states roost records are

accurate to within 700 metres, therefore, it is not possible to determine the distance from the Site Boundary.

11.6.9 Two bat mitigation licences have been granted for barbastelle within the 6 kilometres Study Area. Both relate to the same development for the damage and destruction of a resting place. The record is located 2.4 kilometres west of the Site Boundary in Hockering, at the same location of the building returned as a roost from the NBIS data search. It is assumed to be a barbastelle day roost.

11.6.10 Bat surveys undertaken by third parties as part of planning applications (Broadlands District Council) identified the following roost within the 6 kilometres Study Area. An infrequent non-maternity barbastelle roost was identified within a barn identified for conversion into a dwelling (Hopkins Ecology, 2020, reference 20201592 / 20220438). The building is located 4.3 kilometres north of the Site Boundary.

Roost Identification

11.6.11 The locations of barbastelle roost records identified through the desk study, and roosts identified through surveys undertaken for the Proposed Scheme, are presented on **Figure 11.7** and **Figure 11.8, Appendix 11.10** (Document Reference: 3.11.10). Survey data obtained for the Proposed Scheme have been reported across a number of different reports, that are included as Appendices that accompany the ES. Roosts have been renamed for this Chapter, to aid clarity due to the duplication of roost references. **Table 11-11** provides details of the ES roost reference and previous references used in the Appendix reports.

11.6.12 A review of the desk study data, along with data collected through surveys for the Proposed Scheme, was used to inform a barbastelle colony assessment. A total of five colonies were identified, which are:

- Roarr! Dinosaur Park Colony,
- Royal Norwich Golf Course Colony,

- Primrose Grove Colony,
- Broadway / Telegraph Hill Colony and
- Felthorpe Colony.
- **Table 11-11** provides details of which colony the roosts identified are part of, with further details of the colonies provided from **paragraph 11.6.51** within the Barbastelle Colony Assessment.

Tree Surveys

11.6.13 Tree surveys undertaken in summer between 2019 and 2022 identified two barbastelle roosts:

- ES37: barbastelle day roost. A single barbastelle was present during a climb inspection in August 2019. No handling was undertaken to confirm sex; and
- ES38: barbastelle day roost. One barbastelle recorded emerging during a dusk in July 2020.

11.6.14 ES37 is located in a woodland block immediately south of the Broadway, and ES38 is located within Rose Carr.

11.6.15 No barbastelle roosts were identified during tree hibernation surveys. Full results can be found in **Appendix 11.3: 2021 Bat Roost Survey Report** (Document Reference: 3.11.03).

11.6.16 Three trees (ES98, ES99 and ES100) have been assessed on a precautionary approach. This is due to completion of a partial survey effort, as they have not been subject to standard survey effort as described in the best practice guidelines (Collins, 2016). This is due to surveyors having to cancel the final surveys due to Health & Safety reasons. A reasonable assessment has been made on the three precautionary approach trees whereby a barbastelle day roost has been assumed present within the trees for the purpose of this assessment. ES98 is located along the Broadway, ES99 is located within Foxburrow Plantation and ES100 is located within Rose Carr.

11.6.17 Following the GLTA of the temporary storage area, the recorded roost resource availability within 25 metres of the Red Line Boundary was increased within the vicinity of the Northern Woodland by 21 moderate and nine high suitability trees. It is assumed that all trees of moderate and high suitability within this area have the capacity to support the Primrose Grove barbastelle maternity colony.

Structure Surveys

11.6.18 No barbastelle roosts were identified during summer or hibernation surveys of structures.

Radio-tracking surveys

11.6.19 In total, the following numbers of barbastelles were caught, and a proportion tracked in 2019 / 2021:

- **May 2019:** A total of 8 barbastelles were caught, all of which were fitted with radio-transmitters: seven pregnant females and one adult male.
- **May 2021**: no barbastelles were caught, and surveys were terminated early due to adverse weather conditions (heavy wind and rain).
- **June 2021**: 14 barbastelles were caught and 10 were fitted with radio-transmitters. All were female (parous, pregnant, and non-parous).
- **August 2021:** 21 barbastelles were caught, of which 12 were fitted with radio-transmitters: 11 females (lactating, post-lactating, parous and non-parous) and one adult male.

11.6.20 Thirty-six barbastelle roosts were identified through radio-tracking surveys for the Proposed Scheme, which comprised:

- eight maternity roosts (four confirmed and four assumed) identified in 2019
- an additional 24 maternity roosts (14 confirmed and 10 assumed) identified in 2021;

- one satellite roost identified in 2019;
- one day roost identified in 2021; and
- two inconclusive roosts identified in 2021.

11.6.21 Not all roosts identified through radio-tracking surveys could be characterised through emergence surveys, either because of lack of access or inconclusive results. Lack of access resulted from a lack of consent, or because surveyors could not get sufficiently close for due to health and safety restrictions (i.e. tree located in an area with livestock present). Inconclusive results were due to surveyors only having partial visibility of the tree / feature and therefore unable to undertake an accurate roost count, or where bats did not emerge from the tree. However, the radio-tags indicated that the bats were present within the tree (without having the opportunity to endoscope the feature).

11.6.22 A number of trees were not subject to roost counts due to the number of trees identified. Where accessible, roost trees newly identified the day of survey were prioritised over trees previously identified being resurveyed, to gather data on new roosting locations. These dusk emergence surveys were completed by multiple surveyors simultaneously. If a number of trees were recorded and not all could be covered, the roost counts surveyed were prioritised based on a number of categories including available access, the location of the tree, data available for that colony and the reproductive status of the bats radio-tracked to the trees. In these instances, a maternity roost has been assumed where a breeding female had been tracked back to a roost.

11.6.23 No barbastelle roosts identified through radio-tracking surveys fall within the Site Boundary. One maternity roost (ES34) is present immediately adjacent to the Site Boundary, at the location of a temporary storage area. A further three maternity roosts – one confirmed (ES15) and two assumed (ES12, ES13), and one day roost (ES36) fall within 25 metres of the Site Boundary at the location of temporary storage near Primrose Grove. One additional maternity roost (ES14) is also within 30 metres from the Site Boundary within Rose Carr. All remaining barbastelle roosts identified through radio-tracking surveys are greater than 50 metres from the Site Boundary.

11.6.24 Detailed results can be found in **Appendix 11.1: 2019 Radio-tracking Report** (Document Reference: 3.11.01) and **Appendix 11.2: 2021 Radio-tracking Report** (Document Reference: 3.11.02).

Full Summary

11.6.25 A total of 41 barbastelle roosts have been identified during surveys for the Proposed Scheme, which are detailed in **Table 11-11** and shown on **Figure 11.8, Appendix 11.10** (Document Reference: 3.11.10). These 41 roosts comprise:

- 32 maternity roosts (18 confirmed and 14 assumed);
- one satellite roost;
- three day roosts;
- three assumed day roosts in precautionary approach trees; and
- two inconclusive roosts.

Table 11-11 Barbastelle Roost Summary

Roost Ref (ES)	Appendix	Appendix Roost / Tree Ref	Status	Peak Count	Colony	Grid Ref	Tree or Structure	Distance from Site Boundary
ES01	11.1	1	Maternity	27	Roarr! Dinosaur Park / Royal Norwich Golf Course	TG 11423 17387	Tree	1.20km
ES02	11.1	3	Maternity (assumed)	No access	Broadway / Telegraph Hill	TG 13243 14627	Tree	250m
ES03	11.1	5	Maternity (assumed)	No access	Broadway / Telegraph Hill	TG 11899 13263	Tree	430m
ES04	11.1	6	Maternity (assumed)	Inconclusive	Broadway / Telegraph Hill	TG 11821 13317	Tree	335m
ES05	11.1	7	Maternity	27	Broadway / Telegraph Hill	TG 11843 13325	Tree	345m
ES06	11.1	8	Maternity (assumed)	No access	Roarr! Dinosaur Park / Royal Norwich Golf Course	TG 12012 17316	Tree	1.15km
ES07	11.1	9	Maternity	4	Roarr! Dinosaur Park / Royal Norwich Golf Course	TG 11922 17287	Tree	1.09km
ES08	11.1	10	Satellite	1	Broadway / Telegraph Hill	TG 11683 11434	Tree	2.03km
ES09	11.1	11	Maternity	25	Broadway / Telegraph Hill	TG 11495 12741	Tree	850m
ES10	11.2	R9	Maternity	15	Primrose Grove	TG 13159 14613	Tree	305m
ES11	11.2	R10	Maternity	21	Primrose Grove	TG 13178 14642	Tree	270m
ES12	11.2	R11	Maternity (assumed)	No access	Primrose Grove	TG 13204 14942	Tree	40m
ES13	11.2	R12	Maternity (assumed)	Inconclusive (2)	Primrose Grove	TG 13217 14964	Tree	15m
ES14	11.2	R13	Maternity	18	Primrose Grove	TG 13504 15265	Tree	30m
ES15	11.2	R14	Maternity	3	Primrose Grove	TG 13215 14936	Tree	30m
ES16	11.2	R15	Maternity	4	Primrose Grove	TG 14129 15914	Tree	90m

Roost Ref (ES)	Appendix	Appendix Roost / Tree Ref	Status	Peak Count	Colony	Grid Ref	Tree or Structure	Distance from Site Boundary
ES17	11.2	R16	Maternity	1	Broadway / Telegraph Hill	TG 11842 13321	Tree	345m
ES18	11.2	R17	Maternity (assumed)	Inconclusive – no roost count	Broadway / Telegraph Hill	TG 11868 13062	Tree	580m
ES19	11.2	R18	Inconclusive: signal stationary in roost all night	Inconclusive: signal stationary in roost all night	Broadway / Telegraph Hill	TG 11888 13045	Tree	605m
ES20	11.2	R19	Maternity (assumed)	Inconclusive – restricted access to view tree to undertake roost count	Roarr! Dinosaur Park / Royal Norwich Golf Course	TG 10569 17146	Tree	1.46km
ES21	11.2	R20 / 002	Maternity (assumed)	Inconclusive – restricted access to view tree to undertake roost count	Roarr! Dinosaur Park / Royal Norwich Golf Course	TG 10596 17153	Tree	1.44km
ES22	11.2	R21	Maternity	16	Roarr! Dinosaur Park / Royal Norwich Golf Course	TG 10607 17164	Tree	1.44km
ES23	11.2	R22 / 041	Maternity	16	Roarr! Dinosaur Park / Royal Norwich Golf Course	TG 11908 17285	Tree	1.09km
ES24	11.2	R23	Inconclusive: signal stationary in roost all night	Inconclusive: signal stationary in roost all night	Roarr! Dinosaur Park / Royal Norwich Golf Course	TG 11734 16355	Tree	145m
ES25	11.2	R24	Maternity	6	Roarr! Dinosaur Park / Royal Norwich Golf Course	TG 11579 16954	Tree	750m
ES26	11.2	R25	Maternity	11	Broadway / Telegraph Hill	TG 11884 13203	Tree	465m

Roost Ref (ES)	Appendix	Appendix Roost / Tree Ref	Status	Peak Count	Colony	Grid Ref	Tree or Structure	Distance from Site Boundary
ES27	11.2	R26	Maternity (assumed)	Inconclusive – no roost count	Broadway / Telegraph Hill	TG 11526 12485	Tree	1.10km
ES28	11.2	R29	Maternity (assumed)	Inconclusive – no roost count	Felthorpe	TG 15797 17425	Tree	2.03km
ES29	11.2	R30	Maternity (assumed)	Inconclusive – no roost count	Felthorpe	TG 15193 16812	Tree	1.23km
ES30	11.2	R31	Maternity (assumed)	Inconclusive– no roost count	Felthorpe	TG 15270 16794	Tree	1.24km
ES31	11.2	R32	Maternity	4	Roarr! Dinosaur Park / Royal Norwich Golf Course	TG 11585 16958	Tree	750m
ES32	11.2	R33	Maternity (assumed)	Inconclusive – no roost count	Roarr! Dinosaur Park / Royal Norwich Golf Course	TG 11946 17384	Tree	1.12km
ES33	11.2	R34	Maternity	17	Primrose Grove	TG 13149 14626	Tree	300m
ES34	11.2	R35	Maternity	8	Primrose Grove	TG 13473 14829	Tree	0m
ES35	11.2	R36	Maternity	3	Roarr! Dinosaur Park / Royal Norwich Golf Course	TG 10586 17152	Tree	1.45km
ES36	11.2	R37	Day roost	1	Primrose Grove	TG 13486 14805	Tree	15m
ES37	11.3	11	Day roost	1	Broadway / Telegraph Hill	TG 10958 13751	Tree	7m
ES38	11.3	79	Day roost	1	Primrose Grove	TG 13373 15349	Tree	90m
ES98	11.3	Tree 4	Day roost (assumed)	1	Not applicable	TG 11153 13738	Tree	0m
ES99	11.3	Tree 15	Day roost (assumed)	1	Not applicable	TG 11153 13738	Tree	0m
ES100	11.3	Tree 33	Day roost (assumed)	1	Not applicable	TG 13518 15253	Tree	10m

Commuting Bats

Radio-tracking Flightlines

11.6.26 No bat commuting routes were identified during the 2019 surveys. Four flightlines were recorded within the Site Boundary during the 2021 surveys, with the remainder of the flightlines recorded outside of the Site Boundary. The flightlines within the Site Boundary are:

- a flightline leading from the River Wensum across Fakenham Road towards Juniper Valley woodland;
- a flightline originating in Juniper Valley woodland that traced south across Fakenham Road towards the Wensum Valley wetlands;
- a flightline from ES14 in Rose Carr that followed the Wensum Valley south towards Ringland Hills woodland; and
- a flightline that originated from the Wensum Valley that traced south-east across the Site Boundary and continued along the Wensum Valley wetlands.

11.6.27 Following the identification of the flightlines crossing Fakenham Road, VP surveys were undertaken at locations VP10, VP11 and VP12 in 2022. These surveys identified lower levels of barbastelle commuting activity in comparison to other locations in the Site Boundary. Detailed within **Appendix 11.5: Summer Bat Report** (Document Reference: 3.11.05).

11.6.28 Full results can be found in **Appendix 11.1: 2019 Radio-tracking Report** (Document Reference: 3.11.01) and **Appendix 11.2: 2021 Radio-tracking Report** (Document Reference: 3.11.02).

Vantage Point Surveys

11.6.29 VP survey findings for barbastelle from surveys undertaken between 2019 and 2022 are provided in **Table 11-12**. The locations of 12 VP surveys are shown on **Figure 11.6, Appendix 11.10** (Document Reference: 3.11.10).

11.6.30 As per the DEFRA Local Scale survey guidance (Berthinussen & Altringham 2015), bats recorded as 'using' a feature represent situations where a bat passed along a feature or along the road, or within 5 metres of the feature / road. A total count of bat passes was taken to reflect individual bats seen by the naked eye or NVA. However, as a precautionary approach, a total count was also made reflecting echolocation recordings where a bat pass was heard but the individual bat was not seen.

Table 11-12 Vantage Point surveys – Summary of Results – Barbastelle

VP Ref	Key Feature Used	Max height recorded(m)	Min height recorded(m)	Average height recorded (m)	Total count	Total Count 'Using' the Feature	Peak Count (and month recorded)	Location in relation to the Site Boundary
VP1	Woodland ride	6	4	5.2	61	18 (29.5%)	13 (June)	The Nursery Woodland at the junction of Rose Carr – north of VP9 (outside the Site Boundary)
VP2	No feature – grassland	15	4	9.6	10	5 (50%)	3 (September)	Grassland between The Nursery Woodland and Spring Hills (partially within the Site Boundary / within RLB)
VP3	Open field between woodlands	4	4	4	2	1 (50%)	1 (September)	Grassland between Spring Hills and Long Plantation (within the Site Boundary)
VP4	Hedge lined road	7	6	6.5	4	2 (50%)	2 (August)	Ringland Lane (within the Site Boundary)
VP5	Hedgerow	8	1.5	5.3	108	27 (25%)	19 (September)	Hedgerow north of Weston Road (within the Site Boundary)
VP6	Tree lined road	20	3	7	103	21 (20.4%)	7 (September)	The Broadway (within the Site Boundary)
VP7	Woodland ride	10	3	6.6	55	28 (50.9%)	11 (August)	Ride within Foxburrow Plantation (within the Site Boundary)
VP8	Stream	10	3	7.2	39	11 (28.2%)	4 (July)	Foxburrow Stream (within the Site Boundary)
VP9	Woodland ride	8	1	4.0	1	72 (36.7%)	30 (June)	The Nursery Woodland at the junction of Rose Carr – south of VP1 (within the Site Boundary)
VP10	Across Fakenham Road	10	3	5.3	23	8 (34.8%)	5 (August)	Hedgerow south and north of Fakenham Road (within the Site Boundary)

VP Ref	Key Feature Used	Max height recorded(m)	Min height recorded(m)	Average height recorded (m)	Total count	Total Count 'Using' the Feature	Peak Count (and month recorded)	Location in relation to the Site Boundary
VP11	Single bat not observed by surveyor Thermal Imaging cameras	Not applicable	Not applicable	Not applicable	1	0	0	Hedgerow south of Fakenham Road and woodland copse to the north of Fakenham Road (within the Site Boundary Scheme)
VP12	Across Fakenham Road	10	4	6.3	41	5 (12.2%)	2 (August	Hedgerow south of Fakenham Road and lines of trees north of Fakenham Road (within the Site Boundary)

11.6.31 The highest level of barbastelle activity across all VP surveys was recorded at VP9. This feature is a woodland ride running north to south through the eastern edge of the Nursery Woodland at the junction to Rose Carr (within the Site Boundary). VP1 was located to the north of VP9 at the same woodland ride, and with barbastelle consistently recorded commuting along the woodland ride during each month of survey across all years. This feature was surveyed at two different locations due to a change in the Site Boundary where the road bisects the woodland, with similar results between the two locations.

11.6.32 At VP5, VP6 and VP7, barbastelles were consistently recorded commuting along the features during the surveys. The hedgerows north of Weston Road (VP5), the tree-lined road along the Broadway (VP6) and the woodland ride at Foxburrow Plantation (VP7) are considered as barbastelle flightlines. All VP locations were also subject to automated detector surveys to gather further data on barbastelle activity.

11.6.33 Full results can be found in ES **Appendix 11.4: 2021 Bat Activity Report** (Document Reference: 3.11.04) and **Appendix 11.5: Summer Bat Report** (Document Reference: 3.11.05).

Foraging Bats

11.6.34 Radio-tracking surveys identified the following activity within the Site Boundary:

- 2019 surveys recorded foraging habitat along the Broadway, Foxburrow Plantation and Foxburrow Stream. This is from bats associated with the Broadway / Telegraph Hill Colony;
- 2019 surveys recorded foraging habitat along the River Wensum and Primrose Grove. This is from bats associated with the Primrose Grove and the Royal Norwich Golf Course / Roarr! Dinosaur Park Colonies; and

- 2021 surveys recorded peripheral foraging habitat along the Broadway, Northern Woodlands, and River Wensum.

11.6.35 Full results can be found in ES **Appendix 11.1: 2019 Radio-tracking Report** and (Document Reference: 3.11.01) **Appendix 11.2: 2021 Radio-tracking Report** (Document Reference: 3.11.02).

11.6.36 A summary of the levels of barbastelle activity within each broad habitat type recorded via automated detector surveys during summer 2019, 2020 and 2021, and winter 2020 / 2021 is detailed in **Table 11-13**.

11.6.37 Automated detector locations are shown on **Figure 11.4, Appendix 11.10** (Document Reference: 3.11.10) (summer deployments) and **Figure 11.5, Appendix 11.10** (Document Reference: 3.11.10) (winter deployments), and locations of woodland names and features referred to are shown on **Figure 11.2,** Appendix 11.10 (Document Reference: 3.11.10).

Table 11-13 Automated Detector Surveys – Summary of Results– Barbastelle

Broad Habitat Type	Summer / Winter	No. of Detectors (No of nights total)	Bat Activity Index Value (BAIV)	Peak Detector Activity (passes per night (ppn)) / ASD reference	Peak Activity Location
Woodland	Summer	47 (1063)	10.37	59.48ppn (C38)	Nursery Woodland / Rose Carr junction (immediately north of the Site Boundary)
Woodland	Winter	8 (280)	3.66	7.11ppn (C75)	Rose Carr (outside the Site Boundary)

Broad Habitat Type	Summer / Winter	No. of Detectors (No of nights total)	Bat Activity Index Value (BAIV)	Peak Detector Activity (passes per night (ppn)) / ASD reference	Peak Activity Location
Hedgerow	Summer	30 (701)	5.33	16.24ppn (C82)	Hedgerow north of Fakenham Road (within the Site Boundary)
Hedgerow	Winter	5 (175)	1.48	6.00ppn (C65)	Breck Lane (Breck Road) (within the Site Boundary)
Woodland edge	Winter	6 (210)	6.30	19.60ppn (C21)	The Broadway (within the Site Boundary)
River	Summer	1 (25)	1.60	1.60ppn (C1)	River Wensum (within the Site Boundary)
River	Winter	1(35)	0.09	0.09ppn (C1)	River Wensum (within the Site Boundary)
Grassland	Summer	8 (155)	4.77	18.93ppn (M51)	Grassland between Rose Carr and Spring Hill (within the Red Line Boundary in the Compensation Extent)

11.6.38 The activity levels of barbastelle at each detector during the summer deployment are shown on **Figure 11.9, Appendix 11.10 (Document Reference: 3.11.10)**, with activity levels at each detector during the winter deployment shown on **Figure 11.10, Appendix 11.10 (Document Reference: 3.11.10)**.

11.6.39 The highest level of barbastelle activity across all detectors during the summer surveys was recorded within woodland habitat. Activity levels, in order of activity, in the Site Boundary are detailed below:

- C38 recorded an average of 59.48ppn, located along VP1 / VP9 at the Nursery Woodland / Rose Carr junction (immediately north of the Site Boundary);
- C41 recorded an average of 30.36ppn, located at Foxburrow Plantation adjacent to VP7 (within Site Boundary);
- C58 recorded an average of 24.88ppn, located at the northern edge of Rose Carr (within the Red Line Boundary, in the Compensation Extent); and
- C8 recorded an average of 23.08ppn, located within Long Plantation (within the Site Boundary).

11.6.40 Within grassland habitats during summer surveys, activity levels, in order of activity level, in the Site Boundary are detailed below:

- M51 recorded an average of 18.93ppn, located at grassland between Rose Carr and Spring Hill (within the Red Line Boundary, in the Compensation Extent);
- M43 recorded an average of 6.30ppn, located in grassland near water course 5 (WC5) to the east of Rose Carr within the Site Boundary; and
- M50 recorded an average of 6.07ppn, located in grassland habitat north of Primrose Grove. M50 was installed within the Site Boundary, at the southern end of VP2.

11.6.41 All other grassland locations recorded less than an average of 5.2ppn.

11.6.42 Along hedgerows during summer surveys, activity levels, in order of activity level, in the Site Boundary are detailed below:

- C82 recorded an average of 16.24ppn, recorded at a hedgerow to the north of Fakenham Road that falls within the Site Boundary;
- C87 recorded an average of 13.95ppn, located at a hedgerow located south of Fakenham Road that falls outside of the Site Boundary; and
- C78 recorded an average of 13.52ppn, located at a hedgerow to the north of Weston Road outside of the Site Boundary. This hedgerow however is connected to the hedgerows surveyed in VP5.

11.6.43 R1, which is a hedgerow, is located outside the Red Line Boundary and surveyed as part of a 'control group' at a distance from the Site Boundary. R1 recorded an average of 15.92ppn. This detector was located 450m west from the Site Boundary.

11.6.44 A peak of activity was recorded at C82 in May, with lower levels of activity for the remaining months. This detector was installed at a hedgerow north of Fakenham Road, at the location of VP12. During May surveys at VP12, a total of 20 barbastelle passes were recorded during the surveys. Of these 20 passes, one was of a bat commuting across the road, and the remaining passes were heard but not seen. In total, across all surveys, five bats (12.2%) were recorded crossing the road.

11.6.45 During winter months, the highest level of barbastelle activity across all detectors was recorded within woodland edge habitats. Winter activity levels at woodland edge habitats, in order of activity, are detailed below:

- C21 recorded an average of 19.65ppn, located along the Broadway within the Site Boundary at the location of VP5;
- C62 recorded an average of 7.28ppn, located west along the Broadway within Site Boundary; and

- C63 recorded an average of 4.40ppn, located east along the within Site Boundary.

11.6.46 Following woodland edge habitats, the next highest levels of barbastelle activity recorded during the winter surveys were within woodland habitats. The locations that recorded the highest activity levels, in order of activity, in the Site Boundary are detailed below:

- C75 recorded an average of 7.11ppn, located at Rose Carr within the Red Line Boundary, in the Compensation Extent ;
- C68 recorded an average of 7.05ppn, located at Gravelpit Plantation within the Site Boundary; and
- C73 recorded an average of 6.08ppn installed at the Nursery Woodland / Primrose Grove junction within the Site Boundary.

11.6.47 During the winter months along hedgerow habitats, the highest amount of barbastelle activity was recorded at a hedgerow along Breck Lane (Breck Road) (C65). This was an average of 6.00ppn. All remaining detectors along hedgerow habitats during winter recorded low numbers of barbastelle, with an average less than 1ppn.

11.6.48 Low levels of barbastelle activity were recorded across all months of surveys from C1 along the River Wensum, with an average of 1.60ppn in summer, and 0.09ppn in winter.

11.6.49 Full results can be found in ES **Appendix 11.4: 2021 Bat Activity Report** (Document Reference: 3.11.04) and **Appendix 11.5: Summer Bat Report** (Document Reference: 3.11.05).

Barbastelle Colony Assessment

11.6.50 A review of desk study data and survey results confirmed the presence of five barbastelle colonies within 6km of the Site Boundary, referred to as:

- Roarr! Dinosaur Park Colony;
- Royal Norwich Golf Course Colony;

- Primrose Grove Colony;
- Broadway / Telegraph Hill Colony; and
- Felthorpe Colony.

11.6.51 Indicative boundaries of the five barbastelle colonies are shown on **Figure 11.8, Appendix 11,10** (Document Reference: 3.11.10).

Roarr! Dinosaur Park Colony and Royal Norwich Golf Course Colony

11.6.52 These two colonies were initially identified during pre-construction bat surveys for the A1270 Broadland Northway in 2009, 2012 and 2013. The colonies were also surveyed during pre-construction monitoring for the A1270 Broadland Northway in 2018. In 2019 and 2021, surveys undertaken for the Proposed Scheme confirmed the continued presence of maternity roosts within these areas.

11.6.53 These two barbastelle colonies are immediately adjacent to each other, with overlapping core and peripheral foraging zones occurring between the two colonies. During radio-tracking surveys undertaken in 2018 as post-construction monitoring for the A1270 Broadland Northway, it was observed that '*there was very little crossover in roost use between bats tagged in Weston Park* [Royal Norwich Golf Course] *and Roarr! Dinosaur Park, despite the two sites being adjacent to each other (with contiguous habitat). There were also no instances of bats tagged at the Dinosaur Park using any of the roost trees used by the bats tagged at Weston Park*' (Wild Wings, 2019). The desk study review identified 58 roost records that are considered to be bats from the Roarr! Dinosaur Park / Royal Norwich Golf Course colonies. These records are from radio-tracking surveys undertaken in 2009, 2013, 2018, 2019, 2020 and 2021. Radio-tracking surveys for the Proposed Scheme identified 24 roost trees used by bats from these colonies. A summary of the roosts returned from the desk study data review, and roosts identified as part of radio-tracking surveys for the Proposed Scheme are detailed in **Table 11-14**.

11.6.54 A high-level summary of data collected as part of the Wild Wings Ecology Wensum Valley Barbastelle Project from 2018 to 2022 was provided for trees that fell within the Application Site for the Roarr! Dinosaur Park Expansion (Norfolk Dinosaur Park Ltd, 2021). This included roost trees identified through the A1270 Broadland Northway post-development radio-tracking monitoring surveys (Wild Wings Ecology, 2019). No specific details on the number of roost trees recorded during each year or survey, or the number of trees which were subject to simultaneous roost counts was provided.

11.6.55 Two roost trees identified during surveys for the Proposed Scheme in 2021 were confirmed to have previously been identified as barbastelle roost trees through the presence of existing tree tags (ES21 and ES23). A further two roosts (ES22 and ES35), are considered likely to be previously identified roost trees due to the close locations of these roost trees to existing roost points, and the details of the tree features provided. It is considered that there are likely further duplicate roost locations within these datasets. However, as trees were not tagged across all years of survey, it is not possible to determine the number of individual roost trees identified.

11.6.56 Peak counts from roost emergence surveys are provided in **Table 11-14**, along with details of the number of trees these were recorded from where simultaneous roost counts were undertaken.

Table 11-14 Summary of known roosts for Roarr! Dinosaur Park Colony and Royal Norwich Golf Course Colony

Survey Year	Scheme	No. of roost trees / structures identified	Peak count (simultaneous) / no. of trees or structures	Source
2009	A1270 Broadland Northway – pre-development baseline surveys	10	69 / 4 trees	BSG, 2010

Survey Year	Scheme	No. of roost trees / structures identified	Peak count (simultaneous) / no. of trees or structures	Source
2013	A1270 Broadland Northway – pre-development baseline surveys	5	5 / 1 tree	Greena Ecology, 2013a
2018	A1270 Broadland Northway – post development monitoring surveys	32	46 / 4 trees	Wild Wings Ecology, 2019
2020 to 2021	Roarr! Dinosaur Park – data collected as part Wild Wings Ecology Wensum Valley Barbastelle Project	19 included within ES; however, data from 2018 A1270 Broadland Northway surveys included within this count.	Peak count of 105 recorded in 2020 – 2021 at Roarr! Dinosaur Park. No details provided on the number of trees this count was recorded from.	Norfolk Dinosaur Park Ltd, 2021
2019	The Proposed Scheme – pre-development baseline surveys	3	27 / 1 tree	Appendix 11.1 (Document Reference: 3.11.01)

Survey Year	Scheme	No. of roost trees / structures identified	Peak count (simultaneous) / no. of trees or structures	Source
2021	The Proposed Scheme – pre-development baseline surveys	9	22 / 2 trees	Appendix 11.2 (Document Reference: 3.11.02)

11.6.57 During the May 2019 surveys, one pregnant female bat was caught at Royal Norwich Golf Course that was recorded roosting in Telegraph Hill at ES02, ES03 and ES05. This bat was also recorded roosting with another pregnant female caught at the Broadway in ES05. This may indicate a level of interaction between the Roarr! Dinosaur Park / Royal Norwich Golf Course and Broadway / Telegraph Hill Colony areas. The Broadway (VP6), Foxburrow Plantation (VP7 and VP8) and the hedgerow north of Weston Road (VP5) provide commuting opportunities between these locations.

11.6.58 The maximum foraging radius recorded from individual barbastelles from the Roarr! Dinosaur Park and Royal Norwich Golf Course Colonies ranged from 1.1 kilometres to 8.9 kilometres. The mean-maximum foraging radius (CSZ) recorded from this data set was 5.4 kilometres (**Appendix 11.2: 2021 Radio-tracking Report** (Document Reference: 3.11.02)). Core foraging habitat for these species was recorded within the woodland habitats at Roarr! Dinosaur Park and Royal Norwich Golf Course during June 2021 radio-tracking surveys. During August 2021 radio-tracking surveys, core foraging habitat was identified within wetland habitat associated with the River Wensum to the west of Roarr! Dinosaur Park, and riparian habitat to the west of the Royal Norwich Golf Course, north of Fakenham Road. Surveys in 2019 also identified barbastelles foraging in Spring Hills and Broome Hill, which are part of the Northern Woodland complex.

Primrose Grove Colony

11.6.59 Barbastelle activity was noted within this colony area when a female (non-visibly pregnant) barbastelle was tracked to Ringland Plantation during post-construction monitoring for the A1270 Broadland Northway in 2018. The exact location of the roost could not be located due to not having land access (Mott Macdonald, 2020). Further surveys were then undertaken for the Proposed Scheme in the surrounding woodlands in 2019.

11.6.60 During 2019 surveys, one trapping site was located in Long Plantation (adjacent to Ringland Plantation), and a second in Broom Hills / Spring Hill. Barbastelles were only caught at Broom Hills / Spring Hill. The June and August 2021 surveys included trapping locations in Long Plantation, Rose Carr, and Primrose Grove, with barbastelle caught at all locations. Radio-tracking surveys identified a cluster of maternity roosts within the Northern Woodlands. This comprised a maternity roost within Rose Carr, and further maternity roosts in Primrose Grove and Long Plantation. These surveys confirmed the presence of a barbastelle colony associated with Rose Carr, Primrose Grove, the Nursery Woodland, and Long Plantation woodlands, i.e. the Primrose Grove colony.

11.6.61 The 2018 radio-tracking for the A1270 Broadland Northway confirmed a single roost within these woodland blocks. A further two roost records; a maternity roost, and an unspecified roost type (minimum two adult females) were returned from the NBIS data search, with both records for the same location within the Site Boundary at the Nursery Woodland. These roost records are stated as accurate to within 700 metres, and it is considered that they are likely to be within the Northern Woodland complex due to the expanse of suitable roosting habitat present.

11.6.62 Radio-tracking surveys for the Proposed Scheme identified ten roost trees. Additionally, dusk emergence surveys undertaken outside of radio-tracking surveys, identified a single roost tree that is considered to be used by bats from this colony. A summary of the roosts returned from the desk study data

review, roosts identified as part of radio-tracking surveys, and peak counts from surveys of these roosts are detailed in **Table 11-15**.

Table 11-15 Summary of known roosts for Primrose Grove Colony

Survey Year	Scheme	No. of roost trees / structures identified	Peak count (simultaneous) / no. of trees or structures	Source
2018	A1270 Broadland Northway – post development monitoring surveys	1	Unknown – no access	Wild Wings Ecology, 2019
2019	Proposed Scheme – pre-development baseline surveys	1	1 / 1 tree	Appendix 11.3 (Document Reference: 3.11.03)
2021	Proposed Scheme – pre-development baseline surveys	10	27 / 1 tree	Appendix 11.2 (Document Reference: 3.11.02)

11.6.63 The Nursery Woodland is located between Rose Carr and Primrose Grove, providing connective woodland habitat between the two woodlands. Barbastelle were recorded during VP1 and VP9 commuting along a track running north to south through the Nursery Woodland. Barbastelle were recorded commuting both north and south, and also recorded foraging along with woodland ride. This flightline connects the maternity roost and day roost in Rose Carr with the rest of the roosts recorded within Primrose Grove. During radio-tracking surveys, a flightline was recorded from ES14 in Rose

Carr that followed the Wensum Valley south towards Ringland Hills woodland. A second flightline was recorded that originated from the Wensum Valley north of Rose Carr, which traced south-east across the Site Boundary and continued along the Wensum Valley wetlands.

11.6.64 The maximum foraging radius recorded from individual barbastelles from the Primrose Grove colony ranged from 1.8 kilometres to 2.7 kilometres. The mean-maximum foraging radius (CSZ) recorded from this data set was 2.6 kilometres (**Appendix 11.2: 2021 Radio -tracking Report** (Document Reference: 3.11.02)). The core foraging habitat for this colony is within Primrose Grove, Long Plantation and wetlands surrounding the Wensum valley located east of the Site Boundary. This area is much smaller than the CSZ indicated in other studies (BCT, 2016; Collins, 2023).

11.6.65 During automated static surveys, in the summer months, the highest amount of barbastelle activity across all woodland habitats was recorded within the Northern Woodlands. This was recorded at the Nursery Woodland / Rose Carr junction (within the Site Boundary), with high levels of activity also recorded in Rose Carr and Spring Hills, and grassland present between these two woodland blocks. These are all located outside of the Site Boundary. During winter surveys, the highest amount of barbastelle activity was recorded within Rose Carr (outside of the Site Boundary).

11.6.66 Flightlines recorded during radio-tracking surveys were recorded between Rose Carr and the wetlands associated with the River Wensum; core foraging habitat for this colony. Peripheral foraging habitat was also recorded across the Northern Woodlands Complex, Long Plantation, Gravelpit Plantation, and arable fields between the River Wensum and Ringland. The foraging habitat identified for the Roarr! Dinosaur Park / Royal Norwich Golf Course colonies and the Primrose Grove colony overlap within the Northern Woodlands, in Spring Hills and Broome Hill.

11.6.67 During radio-tracking surveys undertaken in 2021 for the Proposed Scheme, a lactating female bat that was trapped within Primrose Grove was recorded roosting within the Felthorpe area. Flightlines leading across Fakenham Road were recorded during the radio-tracking surveys, which was then subject to VP surveys (VP10 and VP11). This may indicate a level of interaction between the Primrose Grove and Felthorpe colony areas. As access was not gained to complete the emergence surveys and the Felthorpe colony was not targeted for survey, it cannot be confirmed if bats from the two colonies share the same roosts, or just the same woodland roost resource.

Broadway / Telegraph Hill Colony

11.6.68 Bat trapping surveys undertaken in May 2019 identified a cluster of barbastelle roosts in a woodland close to the Broadway (WSP, 2020). Further radio-tracking surveys for the Proposed Scheme undertaken in 2021 recorded a cluster of maternity roosts in Ringland Covert, New Plantation and Telegraph Hill to the east.

11.6.69 A barbastelle day roost (ES37) was recorded south of the Broadway in August 2019. This roost may be associated with the Broadway / Telegraph Hill colony; however, this was not confirmed. This roost was identified through climbing inspection surveys (rather than radio-tracking), and this bat was only present on one of the three summer survey replicates (and was not present during hibernation surveys). The Broadway provides habitat connection between this day roost and the maternity roosts identified in Telegraph Hill. VP6 positioned on the Broadway recorded barbastelles commuting both east and west along this feature.

11.6.70 A total of 11 roost trees were identified through radio-tracking surveys for the Proposed Scheme, which are summarised in **Table 11-16**.

Table 11-16 Summary of known roosts for Broadway / Telegraph Hill Colony

Survey Year	Scheme	No. of roost trees / structures identified	Peak count (simultaneous) / no. of trees or structures	Source
2019	Proposed Scheme – pre-development baseline surveys	5	27 / 1 tree	Appendix 11.1 (Document Reference: 3.11.01)
2020	Proposed Scheme – pre-development baseline surveys	1	1 / 1 tree	Appendix 11.3 (Document Reference: 3.11.03)
2021	Proposed Scheme – pre-development baseline surveys	5	11 / 1 tree	Appendix 11.2 (Document Reference: 3.11.02)

11.6.71 Barbastelle were recorded during all months of automated detector surveys undertaken along the Broadway with the exception of January, with the highest amount of winter barbastelle activity recorded at this location. Activity at detectors along the Broadway, within the Site Boundary, and to its west and the east indicated that use of the Broadway as a winter flightline. Peripheral foraging habitat was identified during radio-tracking surveys in the woodland here.

11.6.72 Foxburrow Plantation is a strip of broad-leaved plantation bordered to the south by Foxburrow Stream, a tributary that feeds into the River Tudd. This woodland recorded the second highest amount of barbastelle activity across all summer automated detector locations in woodland habitats. Foxburrow woodland is located to the west of where the maternity roosts were identified within Ringland Covert, New Plantation and Telegraph Hill. Foxburrow Stream leads from Foxburrow Plantation to the edge of New Plantation. Barbastelle were recorded commuting along a woodland ride within Foxburrow Plantation during VP7, and along Foxburrow Stream during VP8. No foraging areas were identified during radio-tracking surveys in the area of Foxburrow Plantation within the Site Boundary. However, core and peripheral foraging areas were identified for this colony further south-east along Foxburrow Stream, outside of the Site Boundary.

11.6.73 Automated detector surveys that were undertaken for the Sheringham and Dudgeon Extension Projects placed automated detectors within Ringland Covert, which falls within the Broadway / Telegraph Hill Colony extent. A significant peak in barbastelle passes were recorded in July 2021, which suggested the presence of maternity roosts or roosts nearby (Equinor, 2022). This is consistent with the findings of the radio-tracking surveys.

11.6.74 A possible interaction between the Broadway / Telegraph Hill Colony and The Roarr! Dinosaur Park Colony / Royal Norwich Golf Course Colonies has been recorded, as detailed in **paragraph 11.6.58**.

Felthorpe Colony

11.6.75 Pre-construction bat surveys (2009, 2012 and 2013) undertaken to inform the A1270 Broadland Northway identified barbastelle ‘hot spots’ in the Felthorpe Area. During 2018 post-construction monitoring, land access was not granted for bat trapping and radio-tracking at a key site at Felthorpe. Only a single location within the Felthorpe area was able to be trapped, with no barbastelles caught.

11.6.76 The desk study review identified 25 roost records that are considered to be bats from the Felthorpe colony. These records are from radio-tracking surveys undertaken in 2009, 2013 and 2018, separate from those undertaken for the Proposed Scheme.

11.6.77 A summary of the roosts returned from the desk study data review are detailed in **Table 11-17**.

Table 11-17 Summary of known roosts for Felthorpe Colony

Survey Year	Scheme	No. of roost trees / structures identified	Peak count of barbastelle / no. of trees	Source
2009	A1270 Broadland Northway – pre-development baseline surveys	18	Unknown – roost counts not provided	BSG, 2010
2013	A1270 Broadland Northway – pre-development baseline surveys	4	Unknown – no roost counts completed	Greena Ecology, 2013a
2021	The Proposed Scheme – pre-development baseline surveys	3	Unknown – no roost counts completed	Appendix 11.2 (Document Reference: 3.11.02)

11.6.78 A lactating female barbastelle caught in Primrose Grove was recorded roosting within woodlands south of Felthorpe. This bat was not recorded roosting within the Primrose Grove colony during the period of the radio-tracking surveys. No land access was available to undertake roost counts of these trees; however, due to the presence of a lactating bat, it has been assumed that these are maternity roosts.

11.6.79 No surveys for the Proposed Scheme occurred within Felthorpe. However, an area of arable land with hedgerows located north of Fakenham Road , between the road and Juniper Valley Woodland was surveyed. This included VP10, VP11 and VP12, and ASDs C82 to C90.

11.6.80 Of those surveyed, VP10, VP11 and VP12 recorded some of the lowest barbastelle activity. In total across all surveys, barbastelle passes recorded from bats crossing the road include 8 (34.8%) at VP10, 6 bats (12.2%) at VP12; no bats were recorded crossing at VP11. Barbastelle were also recorded foraging along the hedgerows and adjacent habitats during the VP surveys, with ASDs recording barbastelle activity at the detectors installed both north and immediately south of Fakenham Road (both within and outside the Site Boundary).

Barbastelle Geographical Value

11.6.81 Barbastelle fall under legislative and policy protection, including being an EPS and listed on Annex II of the Habitats Regulations; receiving protection under the WCA; categorised as 'Near Threatened' on the International Union for the Conservation of Nature Red List of Threatened Species (Piraccini; 2016); listed as 'vulnerable' in the Mammal Society's Red List of UK Mammals (Mathews and Harrower; 2020); and identified as a SPI (Section 41 of the NERC Act; 2006).

11.6.82 Though not listed as a SSSI at the time of assessment, it should be noted that a site listed as Wensum Woodlands, Norfolk, is under consideration for designation as a SSSI by NE (Natural England, 2022a). A red line boundary for the proposed designation and the reasoning behind consideration has not been released. However, given its location, this may be due to the barbastelle population in the area.

11.6.83 Barbastelle is listed in the BMG (Reason, P.F. and Wray, S., 2023) as 'rarest Annex II species'. Given this, the roosts within and adjacent to the Scheme fall under the following geographic value:

- Maternity colonies and roosts: County / Regional importance on size;

- Day roosts: Site / Local / District, dependent on local distribution; and
- Night-roosts, Individual or very small occasional / transitional / opportunistic roosts: Site (well-used night roosts may be of Local importance for some species).

11.6.84 At a national scale, barbastelle are regarded as rare in the UK (BCT, 2010a). However, Norfolk is considered a stronghold for this species. Barbastelle is listed on the Norfolk Biodiversity Action Plan (NBAP) as having a 'Likely Significant Population' (NBAP, 2009a) and the Norfolk Bat Study Group (NBSG) quotes that 'this nationally rare species [barbastelle] is now regarded *as something of a Norfolk speciality*" and that gaps in distribution within Norfolk are "*probably a reflection of the lack of studies in those areas, but we expect colonies* [of barbastelle] *to be present wherever there are suitable roost woodlands*" (Harris, J. 2020).

11.6.85 Bat groups within the south and east of England are starting to target barbastelle research. A number of bat groups that border and / or are close to Norfolk were contacted for information on barbastelle research projects being undertaken. Where information has been published it was noted that a number of groups are returning records of previously unknown populations and barbastelle roosts with larger numbers of individuals present than previously recorded.

11.6.86 Hertfordshire and Middlesex Bat Group are working on the Hertfordshire Barbastelle Bat Project. Prior to commencing the project, only a single barbastelle maternity colony had been recorded during 2012 (Herts & Middlesex Wildlife Trust, 2019). The project recorded hundreds of barbastelle passes within targeted woodlands. Roosts were identified through radio-tracking and, in the course of simultaneous counts of trees within a single woodland in Stevenage, a total count of 90 barbastelle was recorded. Thus, with targeted barbastelle surveys, the bat group increased the known distribution of the species across their county, including the known number of maternity roosts and size of those roosts.

11.6.87 Suffolk Bat Group has produced a distribution atlas for bats. A figure within the atlas (on page 3), shows a significant increase in barbastelle records along the Suffolk / Norfolk border.

11.6.88 Essex Bat Group are working on the Danbury Barbastelle Project. Though this project is yet to find and undertake counts of maternity roosts, they have completed a number of ASD assessments. During these surveys, barbastelle have been recorded within every wood that they have surveyed (Essex Bat Group, 2021).

11.6.89 The Definition of Favourable Conservation Status for barbastelle bat RP2974 Natural England report notes that '*given the difficulty in locating and monitoring colonies of barbastelles there may be many more colonies that are not currently known, or the average size of known colonies may be larger than currently estimated*' (Zeale and Natural England, 2024).

11.6.90 Barbastelle is a species with quiet echolocation calls (so it was likely under-recorded / recognised in the past). Therefore, improvements in equipment and projects targeting this species likely account for this increase in numbers being observed. Although a greater number of barbastelles is being recorded, this is unlikely to reflect an increase in abundance, rather an increase in detectability. Therefore, assessments on population trends would be difficult to achieve.

11.6.91 Norfolk is considered a stronghold for the species and the ever-growing evidence of the species in the surrounding counties should also be taken into consideration. Given this and following guidance in the BMG, the Primrose Grove and Broadway / Telegraph Hill barbastelle populations are at least of Regional value.

11.6.92 Given the above, survey results, the BMG value, and the stronghold position for this species not only in Norfolk, but potentially within surrounding counties, barbastelle is considered to be an Important Ecological Feature of national value.

Brown Long-eared Bat

Desk Study

11.6.93 The locations of roosts from the desk study records are presented on **Figure 11.11, Appendix 11.10** (Document Reference: 3.11.10).

11.6.94 No statutory or non-statutory designated sites for brown long-eared bats were identified within the Study Area.

11.6.95 A review of historic radio-tracking data was undertaken, as detailed in **Section 11.5.18**, which returned two roost records within the 3-kilometre Study Area (based on the CSZ for this species (BCT, 2023)). These roosts are summarised below:

- one maternity roost within the Site Boundary identified in 2009. This tree roost was located within the footprint of Fakenham Road , and was licensed for destruction and felled to facilitate construction of the A1270 Broadland Northway prior to surveys for the Proposed Scheme; and
- one maternity roost in a building located 70m north-east of the Site Boundary, identified in 2009.

11.6.96 Bat boxes were installed as compensation for roost loss as part of the A1270 Broadland Northway This included three boxes (1 – 3) approximately 90 metres to the north of the Site Boundary in Juniper woodland. A further three boxes (4 – 6) were located 500 metres west of the Site Boundary, at Fakenham Road in a woodland copse immediately north of the A1270 Broadland Northway. All other boxes installed for the A1270 Broadland Northway are located greater than 3 kilometres from the Site Boundary. Of these six boxes, brown long-eared bats were confirmed in Box 2 in Juniper woodland during Year 1 monitoring (Mott Macdonald, 2019a).

11.6.97 Post-construction monitoring was undertaken of the retained maternity roost in the building located 70 metres north-east of the Site Boundary. During Year 1 monitoring in 2019, no evidence of a roost was recorded during the dusk emergence / dawn re-entry surveys (Mott Macdonald, 2019a). During Year 3

monitoring in 2021, two brown long-eared bats were recorded during the dusk emergence / dawn re-entry surveys (Mott Macdonald, 2021a). During the Year 3 hibernation monitoring, a single brown long- eared bat observed in a storeroom of Horsham church, located approximately 7 kilometres east of the Proposed Scheme (Mott Macdonald, 2021b).

11.6.98 NBIS returned 73 records of brown long-eared bats within the 3-kilometre Study Area from within the last ten years. Of these, 18 were roost records. These roost records are summarised below:

- one roost in a building located 745 metres south-east of the Site Boundary in Ringland, (unspecified roost type – confirmed via droppings only);
- one roost in a building located 885 metres south of the Site Boundary near Honingham (unspecified roost type – confirmed via droppings only);
- one record of a roost in a building located 1.1 kilometres north of the Site Boundary near Morton (unspecified roost type);
- one roost in church located 1.4 kilometres south of the Site Boundary near East Tudderham (peak count one bat);
- one maternity roost in a building in Taverham Hall located 1.5 kilometres east of the Site Boundary;
- one maternity roost in a building located 2.1 kilometres east of the Site Boundary adjacent to the River Tudd;
- two records of a maternity roost in a building located 2.2 kilometres north of Site Boundary near Morton;

- two maternity roosts (one confirmed and one assumed) in buildings located 2.3 kilometres north of the Site Boundary near Felthorpe. One roost was returned as a confirmed maternity roost with 21 bats present, and the second is an assumed maternity roost due to the presence of eight bats;
- one roost in a building 2.4 kilometres north of the Site Boundary near Felthorpe (unspecified roost type);
- one roost in a building located 2.4 kilometres west of the Site Boundary near Hockering (peak count two bats);
- one assumed maternity roost in a building located 2.6 kilometres north of the Site Boundary near Swannington (assumed maternity roost due to the presence of 11 bats);
- one night roost / feeding perch in a church 2.6 kilometres south of the Site Boundary south of East Tudderham;
- one roost in a church located 2.7 kilometres north of the Site Boundary near Felthorpe (unspecified roost type – confirmed via droppings);
- one day roost in a tree located 2.8 kilometres east of the Site Boundary near Queen's Hill; and
- one day roost in a building in a church near Easton, 2.9 kilometres south-east of the Site Boundary.

11.6.99 Eleven EPS licences have been granted for brown long-eared bats within the 3-kilometre Study Area, with the closest recorded being of an unknown roost type located 950 metres north of the Site Boundary near Morton.

11.6.100 Bat surveys undertaken by third parties as part of planning applications (Broadland District Council) identified the following roosts within the 3-kilometre Study Area:

- destruction of brown long-eared bat maternity roost located 1.1 kilometres north of the Site Boundary (Wild Frontier Ecology, 2015, reference 20151771);
- destruction of a brown long-eared bat maternity roost located 1.3 kilometres north-west of the Site Boundary (MHE Consulting Ltd, 2017, reference 20200376);
- destruction of a day roost of brown long-eared bat located 1.5 kilometres east of the Site Boundary (TORC Ecology, 2018, reference 20172130); and
- destruction and disturbance of brown long-eared bat maternity roost located 1.5 kilometres east of the Site Boundary (Insight Ecology, 2017, reference 20180481 / 20180525 / 20180540) This roost was also returned via the NBIS data request.

Roost Identification

11.6.101 The locations of brown-long eared bat roosts identified through the desk study, and roosts identified through surveys undertaken for the Proposed Scheme, are presented on **Figure 11.11, Appendix 11.10** (Document Reference: 3.11.10). Survey data obtained for the Proposed Scheme has been reported across a number of different reports, which are included as Appendices that accompany the ES. Roosts have been renamed for this Chapter, to aid clarity due to the duplication of roost references. **Table 11-18** provides details of the ES roost reference and previous references used in the Appendix reports.

Tree Surveys

11.6.102 Tree surveys undertaken in summer between 2019 and 2022 identified four brown long-eared bat roosts. Three were identified during climbing inspections (ES42, ES47 and ES70), and two identified during dusk surveys (ES44 and ES48). These roosts are located within Rose Carr (ES44, ES47), Foxburrow Plantation (ES42 and ES70) and a woodland copse south of Foxburrow Plantation (ES197).

11.6.103 Back-tracking surveys undertaken in 2020 identified one maternity roost (ES43) in Gravelpit Plantation.

11.6.104 Hibernation climbing surveys identified two hibernation roosts (ES45 and ES46) in Rose Carr. Both trees contained only a single hibernating bat.

11.6.105 Full results can be found in ES **Appendix 11.3: 2021 Bat Roost Survey Report** (Document Reference: 3.11.03).

Structure Surveys

11.6.106 Structure surveys undertaken in summer identified one brown long-eared bat day roost in ES55. Droppings were present during internal inspection of a residential building; however, no bats were recorded during dusk emergence / dawn re-entry surveys. This building is located adjacent to Site Boundary, south of Weston Road.

11.6.107 Hibernation surveys of structures identified six brown long-eared bat hibernation roosts. Brown long-eared bats were recorded hibernating in an above ground bunker (ES53) and five underground bunkers (ES49, ES50, ES51, ES52, ES54). A peak count of three brown long-eared bats were recorded hibernating in ES52, with the remaining structures only recording individual bats. One roost (ES50) was considered historic, due to the only evidence being of dead bats.

11.6.108 Three of the bunkers (ES49, ES52 and ES54) are located within Foxburrow Plantation, two bunkers are located in woodland immediately south of the Broadway to the west of the Site Boundary (ES50, ES51) and one bunker in woodland immediately north of the Broadway to the east of the Site Boundary (ES53).

11.6.109 Full results can be found in ES **Appendix 11.3: 2021 Bat Roost Survey Report** (Document Reference: 3.11.03).

Radio-tracking surveys

11.6.110 A total of four brown long-eared bats were caught during the 2019 radio-tracking surveys, with none subject to radio-tracking. A total of 30 brown long-eared bats were caught during the 2021 radio-tracking surveys, with one parous female and one lactating female fitted with radio-transmitters.

11.6.111 Three roosts were identified through radio-tracking surveys for the Proposed Scheme which comprised:

- one maternity roost in a bungalow located 85m east from the Site Boundary in Telegraph Hill; and
- two assumed maternity roosts within two trees located 225m and 295m south-east of the Site Boundary in Foxburrow Plantation.

11.6.112 Full results can be found in ES **Appendix 11.1: 2019 Radio-tracking Report** (Document Reference: 3.11.01) and **Appendix 11.2: 2021 Radio-tracking Report** (Document Reference: 3.11.02).

Full Summary

11.6.113 A total of 18 brown long-eared bat roosts have been identified during surveys for the Proposed Scheme which are detailed in **Table 11-18** and shown on **Figure 11.11, Appendix 11.10** (Document Reference: 3.11.10). These 18 roosts comprise:

- four maternity roosts (two confirmed and two assumed);
- six day roosts (five confirmed and one assumed); and
- eight hibernation roosts (one historic due to the presence of dead bats only).

Table 11-18 Brown long-eared bat Roost Summary

Roost No. (ES)	Appendix	Appendix Roost Ref	Status	Peak Count	Grid Reference	Tree or Structure	Distance from Site Boundary
ES39	11.1	R8	Maternity	20	TG 11655 13509	Structure	85m
ES40	11.1	R27	Inconclusive (assumed maternity)	No Access	TG 11027 13177	Tree	295m
ES41	11.1	R28	Inconclusive (assumed maternity)	No Access	TG 10932 13191	Tree	225m
ES42	11.3	60	Day roost	1	TG 10529 13401	Tree	0m
ES43	11.3	107	Maternity	9	TG 12412 15001	Tree	0m
ES44	11.3	193	Day roost	3	TG 10330 13373	Tree	6m
ES45	11.3	78	Hibernation	1	TG 13373 15346	Tree	90m
ES46	11.3	254	Hibernation	1	TG 13469 15333	Tree	95m
ES47	11.3	329	Day roost	2	TG 13321 15387	Tree	120m
ES48	11.3	197	Day roost	2	TG 09958 12954	Tree	15m

Roost No. (ES)	Appendix	Appendix Roost Ref	Status	Peak Count	Grid Reference	Tree or Structure	Distance from Site Boundary
ES49	11.3	11A2	Hibernation	Droppings only	TG 10512 13528	Structure	60m
ES50	11.3	9B4	Hibernation (historic)	3 (dead)	TG 10480 13844	Structure	15m
ES51	11.3	9B6	Hibernation	1	TG 10520 13837	Structure	15m
ES52	11.3	11A3	Hibernation	3	TG 10586 13487	Structure	0m
ES53	11.3	10A3	Hibernation	1	TG 11327 13716	Structure	0m
ES54	11.3	11A1	Hibernation	1	TG 10619 13561	Structure	45m
ES55	11.3	8A1	Inconclusive (assumed day roost)	Droppings only	TG 11456 14622	Structure	41
ES70	11.3	20	Day roost	3	TG 10665 13347	Tree	0m

Commuting and Foraging

Radio-tracking Flightlines

11.6.114 Radio-tracking surveys in 2021 identified core and peripheral foraging habitat for brown long-eared bats in woodlands immediately south of the Broadway, and within Foxburrow Plantation that are partially within the Site Boundary. Additional foraging habitat was recorded in Telegraph Hill outside of the Site Boundary.

11.6.115 Due to the small sample size (two bats), the data collected through radio-tracking surveys reflects individual bats tracked rather than providing an overall picture of brown long-eared behaviour within the Site Boundary. This data is used in combination with ASD surveys to determine areas of brown long-eared bat activity.

11.6.116 Full results can be found in **Appendix 11.2: 2021 Radio-tracking Report** (Document Reference: 3.11.02).

Incidental Vantage Point Surveys

11.6.117 During VP surveys, brown long-eared bats were incidentally recorded commuting and foraging. Records of brown long-eared bats were recorded at all VP locations, with behaviour noted at the following locations:

- commuting in both directions along the woodland ride surveyed at VP1 and VP9 in the Nursery Woodland;
- foraging bats recorded in the grassland surveyed at VP2, and foraging along the woodland edge of Long Plantation surveyed at VP3;
- commuting along the hedgerow north of Weston Road surveyed at VP5, and foraging within the long grass surrounding the hedgerow at VP5; and
- foraging and commuting recorded at hedgerows surveyed at VP10 and VP12, and a woodland copse surveyed at VP11, all located north of Fakenham Road.

Automated Static Detectors

11.6.118 A summary of the levels of brown long-eared bat activity within each broad habitat type recorded via automated detector surveys during summer 2019, 2020 and 2021, and winter 2020 / 2021 is detailed in **Table 11-19**.

11.6.119 Automated detector locations shown on **Figure 11.4, Appendix 11.10** (Document Reference: 3.11.10) (summer deployments) and **Figure 11.5, Appendix 11.10** (Document Reference: 3.11.10) (winter deployments), and locations of woodland names and features referred too are shown on **Figure 11.2, Appendix 11.10** (Document Reference: 3.11.10).

11.6.120 Brown long-eared bats have a tendency to use low intensity calls, which are rarely detected unless passing within 5 metres of a detector. Brown long-eared bats also do not always echolocate when foraging, which may result in this species being under detected on automated detectors (Russ J, 2021).

Table 11-19 Automated Detector Surveys – Summary of Results – Brown long-eared bat

Broad Habitat Type	Summer / Winter	No. of Detectors (No of nights total)	Bat Activity Index Value (BAIV)	Peak Detector Activity (ppn) / ASD reference	Peak activity location
Grassland	Summer	8 (155)	9.74	18.73ppn (M43)	Grassland located near WC5 / adjacent to Rose Carr (within Site Boundary)
Hedgerow	Summer	30 (701)	3.60	12.7ppn (C82)	Hedgerow north of Fakenham Road (within the Site Boundary)

Broad Habitat Type	Summer / Winter	No. of Detectors (No of nights total)	Bat Activity Index Value (BAIV)	Peak Detector Activity (ppn) / ASD reference	Peak activity location
Hedgerow	Winter	5 (175)	0.15	0.37ppn (C69)	Hedgerow along Ringland Lane (within the Site Boundary)
River	Summer	1 (25)	1.44	1.44ppn (C1)	River Wensum (within the Site Boundary)
River	Winter	1(35)	0.09	0.09ppn (C1)	River Wensum (within the Site Boundary)
Woodland	Summer	47 (1063)	3.33	27.44ppn (B11i)	Foxburrow Plantation (within the Site Boundary)
Woodland	Winter	8 (280)	0.47	1.54ppn (C73)	Nursery Woodland (within the Site Boundary)
Woodland edge	Winter	6 (210)	0.29	0.6ppn (C70)	Northern edge of Long Plantation (within the Site Boundary)

11.6.121 The activity levels of brown long-eared bats at each detector during the summer deployment is shown on **Figure 11.12**, **Appendix 11.10** (Document Reference: 3.11.10), with activity levels at each detector during the winter deployment shown on **Figure 11.13, Appendix 11.10** (Document Reference: 3.11.10).

11.6.122 The highest level of brown long-eared bat activity across all detectors during the summer surveys was recorded within woodland habitat. Activity levels, in order of activity, in the Site Boundary are detailed below:

- B11i recorded an average of 27.44ppn, located within woodland habitats in Foxburrow Plantation immediately to the north of VP7 (within the Site Boundary);
- M51 recorded an average of 18.73ppn, M52 recorded an average of 16.86ppn and M50 recorded an average of 15.06ppn within grassland habitats. M51, M52 and M50 were all installed along VP2 in the Northern Woodlands, with M50 within the Site Boundary, and M51 and M52 within the Red Line Boundary in the Compensation Extent;
- M43 recorded an average of 15.70ppn, within grassland habitat located near WC5 to the east of Rose Carr, within the Site Boundary;
- C82 recorded an average of 12.68ppn, recorded at a hedgerow to the north of Fakenham Road (at the location of VP12) that falls within the Site Boundary;
- C87 recorded an average of 9.40ppn, recorded at a hedgerow south of Fakenham Road, outside of the Site Boundary;
- C57 recorded an average of 11.60ppn, located woodland habitats in Primrose Grove within the Site Boundary; and
- C48 recorded an average of 7.60ppn located woodland habitats in the Nursery Woodland, at VP9 / VP1 (within the Red Line Boundary in the Compensation Extent).

11.6.123 Low levels of brown long-eared bats were recorded across all months of surveys at C1 installed along the River Wensum, with an average of 1.44ppn in summer and 0.09ppn in winter.

11.6.124 During winter months, lower levels of activity were recorded (as expected), with winter peaks recorded within woodland habitats. Winter activity levels, in order of activity, in the Site Boundary are detailed below:

- Woodland – the highest activity was an average of 1.54ppn in March, recorded at C73 located at the Nursery Woodland / Primrose Grove junction (within the Site Boundary). All other woodland locations recorded an average of less than 1ppn;
- Woodland Edge – all detectors recorded low levels of activity, all less than an average of 0.60ppn; and
- Hedgerows – all detectors recorded low levels of activity, all less than an average of 0.37ppn.

11.6.125 Full results can be found in ES **Appendix 11.4: 2021 Bat Activity Report** (Document Reference: 3.11.04) and **Appendix 11.5: Summer Bat Report** (Document Reference: 3.11.05).

Overall Species Summary

11.6.126 Brown long-eared bats were recorded at all the automated detector survey locations within the Site Boundary. A number of areas of particular importance for brown long-eared bats in the context of the Proposed Scheme were identified through the surveys, which are detailed below in order of north to south.

11.6.127 Three tree roosts were identified in Rose Carr, which is part of the Northern Woodland complex that falls outside of the Site Boundary to the north – hibernation roosts ES45 and ES46, and day roost ES47. The second highest activity levels of brown long-eared bats were recorded within the Northern Woodlands, in both summer and winter. This includes at detectors installed within the Nursery Woodland that falls within the Site Boundary, and within

Rose Carr, Primrose Grove and Spring Hills that fall outside of the Site Boundary. Incidental records of brown long-eared bats were also recorded commuting in both directions along the woodland ride in the Nursery Woodland (VP1 and VP9). The highest activity levels within grassland habitats were recorded in grassland east of Rose Carr and west of the Nursery Woodland. These detectors were installed where VP3 was located, with incidental records of brown-long eared bats recorded at the woodland edge during VP surveys. High levels of activity were also recorded in grassland between Rose Carr and Spring Hills, which is outside of the Site Boundary to the north.

11.6.128 Within Gravelpit Plantation a maternity roost (ES43) was identified during back-tracking surveys in August 2020. The roost falls within the Site Boundary.

11.6.129 At the Broadway, three hibernation roosts were identified in structures. Two are located to the west of Site Boundary (ES50 and ES51), and one within the Site Boundary to the east of the Proposed Scheme alignment (ES53). Brown long-eared bats were recorded along the Broadway during the winter monitoring, with a peak of 1.4ppn recorded at C63 in October followed by 0.8ppn at C63 in October.

11.6.130 Foxburrow Plantation supports the highest number of brown long-eared roosts recorded within the Site Boundary, with seven of the 17 roosts recorded within Foxburrow Plantation or immediately adjacent connective habitat. These seven roosts include two assumed maternity roosts, E40 and E41, that are located 295 metres and 225 metres south-east of the Site Boundary within Foxburrow Plantation. Three hibernation roosts were identified in structures that are located within Foxburrow Plantation or immediately to the north: ES49, E52 and ES54. Two days roosts are located within Foxburrow Plantation or immediately to the south: ES42 and ES44.

11.6.131 Foxburrow Plantation was identified as peripheral foraging habitat during radio-tracking surveys, with the core foraging habitat within woodland outside of the Site Boundary, located downstream of Foxburrow Stream. Automated detector survey findings are consistent with findings of the radio-tracking surveys, with the highest levels of brown long-eared activity recorded within Foxburrow Plantation.

Brown Long-eared Bat Geographical Value

11.6.132 Brown long-eared bat fall under legislative and policy protection, including being an EPS of the Habitats Regulations; receiving protection under the WCA; and identified as a SPI (Section 41 of the NERC Act, 2006).

11.6.133 Within Norfolk, brown long-eared bats are included as a priority species on the NBAP and are listed as being the 'second most common bat in Norfolk' (NBAP, 2009b). The population of brown long-eared bat in England is considered to have been stable since 1999 (BCT, 2023).

11.6.134 Brown long-eared bats are considered to be widespread in all geographies (Reason, P.F. and Wray, S., 2023). Given this, the roosts within and adjacent to Scheme fall under the following geographic value:

- Maternity colonies and roosts: *District*.
- Hibernation (small numbers): *Site*.
- Day roost: *Site*

11.6.135 Given survey results, their stable population and widespread distribution, brown long-eared bats are assessed as being an Important Ecological Feature of District value.

Myotis sp.

Desk Study

11.6.136 The locations of roosts from the desk study records are presented on **Figure 11.14, Appendix 11.10** (Document Reference: 3.11.10).

11.6.137 No statutory or non-statutory designated sites for *Myotis* were identified within the Study Area.

11.6.138 A review of historic radio-tracking data, as detailed in **Section 11.5.18**, returned one roost record within the 4-kilometre Study Area (based on the maximum CSZ of *Myotis* species (BCT, 2023)). A tree supporting a Daubenton's bat (*Myotis daubentonii*) maternity roost was located 3.4 kilometres north of the Site Boundary in 2009.

11.6.139 NBIS returned 143 records of *Myotis* sp. Within the 4-kilometre Study Area within the last ten years. Of these records, three were of roosts, and two records were of Natterer's bats (*Myotis nattereri*) trapped. All remaining records were audio-records. The details of the roost records are summarised below:

- one possible *Myotis* sp recorded hibernating in disused WWII command bunker, 440 metres north-west of the Site Boundary at Breck Road;
- two Daubenton's bats (dead) recorded 2.4 kilometres north of the Site Boundary near Swannington. Historic data from 1973 to 2020 of a hibernation roost, with a peak count of 19 bats recorded (year unspecified). This location is within Alderford Common SSSI, which includes an old limekiln used by bats both as a hibernating site and daytime roost during the summer months; and
- one Natterer's bat roost recorded 2.4 kilometres south of the Site Boundary, south of East Tuddenham (unspecified roost type – confirmed via droppings).

11.6.140 Five EPS licences have been granted for Natterer's bats within the 4-kilometre Study Area, relating to two developments. One was licensed for the destruction of a resting place, 485 metres west of the Site Boundary, and one for damage to a breeding and resting place, 1.5 kilometres south-east of the Site Boundary.

11.6.141 Bat surveys undertaken by third parties as part of planning applications (Broadlands District Council) identified the following roosts within the 4km Study Area which are summarised below:

- destruction of a Natterer's bat day roost located 425 metres west of the Site Boundary (Norfolk Wildlife Services, 2017, reference 20171446); and
- destruction of a Natterer's bat day roost located 1.5 kilometres west of the Site Boundary (TORC Ecology, 2018, reference 20172130).

11.6.142 No roost records of other *Myotis* species were identified within the 4km Study Area.

Roost Identification

11.6.143 The locations of *Myotis* roosts identified through the desk study, and roosts identified through surveys undertaken for the Proposed Scheme, are presented on **Figure 11.14, Appendix 11.10** (Document Reference: 3.11.10). Survey data obtained for the Proposed Scheme has been reported across a number of different reports, which are included as Appendices that accompany the ES. Roosts have been renamed for this Chapter, to aid clarity due to the duplication of roost references. **Table 11-20** provides details of the ES roost reference and previous references used in the Appendix reports.

Tree Surveys

11.6.144 Tree surveys undertaken in summer identified two Natterer's bat day roosts during climbing inspections (ES67 and ES68), located respectively within Gravelpit Plantation and Rose Carr, located outside of the Site Boundary.

11.6.145 Hibernation climbing surveys identified one roost – ES65. One Myotis was present within the tree, with the species unable to be confirmed without causing disturbance to the hibernating bat. This roost is located in Gravelpit Plantation.

11.6.146 One Natterer's bat transitional roost was identified in tree ES66 during climbing surveys. This roost is located in Rose Carr .

11.6.147 Full results can be found in ES **Appendix 11.3: 2021 Bat Roost Survey Report** (Document Reference: 3.11.03).

Structure Surveys

11.6.148 No *Myotis* roosts were identified during summer surveys of structures.

11.6.149 Hibernation surveys of structures identified one Daubenton's bat (ES52) and one *Myotis* species hibernation roost (ES69) in underground bunkers. E52 is located within Gravelpit Plantation, and ES69 is located in an area of woodland immediately south of the Broadway.

11.6.150 No further surveys were undertaken on ES69 to confirm the *Myotis* species identification due to the structure being confirmed as being retained and the distance from the Site Boundary (15 metres south of a haul road).

11.6.151 Full results can be found in ES Appendix **11.3: 2021 Bat Roost Survey Report** (Document Reference: 3.11.03).

Radio-tracking surveys

11.6.152 In total, the number of *Myotis* caught, and the number subject to radio-tracking, during 2019 and 2021 radio-tracking surveys are detailed below:

- nine Natterer's bats and five Daubenton's bats were caught, with one pregnant female Natterer's bat fitted with a radio-transmitter during 2019 surveys; and
- 37 Natterer's bats and 31 Daubenton's bats were caught, with one pregnant Natterer's bat and two pregnant Daubenton's bats fitted with radio-transmitters during 2021 surveys.

11.6.153 Nine *Myotis* roosts were identified through radio-tracking surveys for the Proposed Scheme comprise:

- two Natterer's bat maternity roosts (both assumed) during 2019 surveys;
- three Natterer's bat maternity roosts during 2021 surveys; and

- four Daubenton's bat maternity roosts (three confirmed and one assumed) during 2021 surveys.

11.6.154 No *Myotis* roosts identified through radio-tracking surveys fall within the Site Boundary. Two Natterer's bat roosts (ES56 and ES57) are located within Primrose Grove, and three Natterer's roosts (ES60, ES61 and ES62) and two Daubenton's bat roosts (ES58 and ES59) are located within Morton Plantation. One Daubenton's bat roost is located within Roarr! Dinosaur Park (ES64), and one roost (ES63) within Royal Norwich Golf Course

11.6.155 Full results can be found in ES **Appendix 11.1: 2019 Radio-tracking Report** (Document Reference: 3.11.01) and **Appendix 11.2: 2021 Radio-tracking Report** (Document Reference: 3.11.02).

Full Summary

11.6.156 A total of 15 *Myotis* roosts have been identified during surveys for the Proposed Scheme, which are detailed within **Table 11-20**, and shown on **Figure 11.14, Appendix 11.10** (Document Reference: 3.11.10). These 15 roosts comprise:

- five Natterer's bat maternity roosts (three confirmed and two assumed);
- two Natterer's bat day roost;
- one Natterer's bat transitional roost;
- four Daubenton's bat maternity roosts (three confirmed and one assumed);
- one Daubenton's bat hibernation roost; and
- two *Myotis* sp hibernation roosts.

Table 11-20 Myotis Roost Summary

Roost Ref (ES)	Appendix Recorded	Appendix Roost Ref	Status	Peak Count	Species (if known) (Note 1)	Grid Ref	Tree or Structure	Distance from Site Boundary
ES52	11.3	11A3	Hibernation	1	M.dau	TG 10586 13487	Structure	0m
ES56	11.1	2	Maternity	Not applicable	M.nat	TG 13243 14627	Tree	250m
ES57	11.1	4	Maternity	Not applicable	M.nat	TG 13074 14822	Tree	210m
ES58	11.2	R1	Maternity	Inconclusive – restricted view	M.dau	TG 12010 17265	Tree	1.10km
ES59	11.2	R2	Maternity	21	M.dau	TG 11701 17340	Tree	1.12km
ES60	11.2	R3	Maternity	1	M.nat	TG 11829 17390	Tree	1.18km
ES61	11.2	R4	Maternity	10	M.nat	TG 11870 17433	Tree	1.23km
ES62	11.2	R5	Maternity	10	M.nat	TG 11808 17340	Tree	1.13km
ES63	11.2	R6	Maternity	50	M.dau	TG 10701 17793	Tree	1.86km
ES64	11.2	R7	Maternity	7	M.dau	TG 10610 17558	Tree	1.72km
ES65	11.3	103	Hibernation	1	*Myotis* sp	TG 12422 14993	Tree	0m
ES66	11.3	123	Transitional	1	M.nat	TG 13499 15335	Tree	75m
ES67	11.3	226	Day roost	1	M.nat	TG 12210 15123	Tree	6m
ES68	11.3	214	Day roost	1	M.nat	TG 13362 15395	Tree	135m
ES69	11.3	9B6	Hibernation	1	*Myotis* sp	TG 10520 13837	Structure	15m

Note 1: M.nat = Natterer's bat, M.dau = Daubenton's bat

Commuting Bats

Radio-tracking Flightlines

11.6.157 No flightlines for *Myotis* were identified within the Site Boundary during radio-tracking surveys. All flightlines identified were in habitats surrounding Roarr! Dinosaur Park and Royal Norwich Golf Course, which are from 500 metres north-west of the Site Boundary.

11.6.158 Due to the small sample sizes (as barbastelle were prioritised for tracking), i.e. two Natterer's bats (one in 2019, and one in 2021) and two Daubenton's bats (in 2021), the data collected through radio-tracking surveys reflects individual bats tracked rather than providing an overall picture of Natterer's bats and Daubenton's bat behaviour within the Site Boundary. These data were used in combination with VP surveys, and ASD surveys, to determine areas of *Myotis* activity.

11.6.159 Full results can be found in **Appendix 11.2: 2021 Radio-tracking Report** (Document Reference: 3.11.02).

Vantage Point Surveys

11.6.160 VP survey findings for *Myotis* between 2019 and 2022 are provided in **Table 11-21**. The locations of 12 crossing point surveys are shown on **Figure 11.6, Appendix 11.10** (Document Reference: 3.11.10).

Table 11-21 Vantage Point Surveys – Summary of Results – Myotis

VP Ref	Key Feature Used	Max height recorded (m)	Min height recorded (m)	Average height recorded (m)	Total count	Total Count 'Using' the Feature	Peak Count (and month recorded)	Location in relation to the Proposed Scheme
VP1	Woodland ride	5	3	4.2	34	21 (61.8%)	10 (June)	The Nursery Woodland at the junction of Rose Carr – north of VP9 (outside the Site Boundary)
VP2	No feature – grassland	15	3	9	14	3 (21.4%)	2 (September)	Grassland between The Nursery Woodland and Spring Hills (partially within the Site Boundary)
VP3	Open field between woodlands	10	3	8.8	11	5 (45.5%)	3 (September)	Grassland between Spring Hills and Long Plantation (within the Site Boundary)
VP4	Hedge lined road	10	10	10	3	1 (33.3%)	1 (August)	Ringland Lane (within the Site Boundary)
VP5	Hedgerow	10	1.5	8.25	32	7 (21.9%)	7 (August)	Hedgerow north of Weston Road (within the Site Boundary)
VP6	Tree lined road	3	3	3	11	3 (27.3%)	2 (August)	The Broadway (within the Site Boundary)
VP7	Woodland ride	10	4	6.3	22	7 (31.8%)	6 (September)	Ride within Foxburrow Plantation (within the Site Boundary)
VP8	Stream	5	2	3.6	19	6 (31.6%)	3 (September)	Foxburrow Stream (within the Site Boundary)
VP9	Woodland ride	5	1	2.7	121	28 (23.15%)	10 (June)	The Nursery Woodland at the junction of Rose Carr – south of VP1 (within the Site Boundary)
VP10	Across Fakenham Road	7	2	3.9	37	16 (43.3%)	9 (August)	Hedgerow south and north of Fakenham Road (within the Site Boundary)
VP11	Across Fakenham Road	10	5	8	11	5 (45.5%)	2 (September)	Hedgerow south of Fakenham Road and woodland copse to the north of Fakenham Road (within the Site Boundary)

VP Ref	Key Feature Used	Max height recorded (m)	Min height recorded (m)	Average height recorded (m)	Total count	Total Count 'Using' the Feature	Peak Count (and month recorded)	Location in relation to the Proposed Scheme
VP12	Across Fakenham Road	15	2	7.3	47	6 (12.8%)	3 (August, September)	Hedgerow south of Fakenham Road and lines of trees north of Fakenham Road (within the Site Boundary)

11.6.161 The highest amount of *Myotis* activity across all VP surveys was recorded at VP9. This feature is a woodland ride running north to south through the eastern edge of the Nursery Woodland at the junction to Rose Carr (within the Site Boundary). Of these passes, 23.1% (28 passes) were observed by surveyors using the woodland ride for commuting, with bats recorded commuting both north and south along the feature. A further 19.8% (24 passes) were observed using the feature for foraging. Of the VP surveys, the third highest level of *Myotis* activity was recorded at VP1 (adjacent to VP9 at the north).

11.6.162 The second highest activity was recorded at VP12 at Fakenham Road. A total of 47 *Myotis* species passes were recorded at VP12. Of these passes, 12.8% (six passes) were observed by surveyors commuting across the road. A further 8.5% (four passes) were observed by surveyors foraging during the surveys, with one of the passes observed crossing the road. 50% (three passes) crossed the road at a safe height. The remaining 37 passes were bats heard but not seen.

11.6.163 At VP10, which is further to the west of VP12, a total of 37 *Myotis* species passes were recorded. Of these passes, 43.2% (16 passes) were observed by surveyors to be commuting across the road. A further 5.4% (two passes) were observed by surveyors to be commuting and foraging across the road and 2.7% (one pass) foraging across the road. 26.3% (five passes) crossed the road at a safe height.

Foraging Bats

11.6.164 No core or peripheral foraging habitat for *Myotis* was identified within the Site Boundary during radio-tracking surveys. All foraging habitat was in habitats surrounding Roarr! Dinosaur Park and Royal Norwich Golf Course, which are from 500 metres north-west of the Site Boundary, from the location of access road at Marl Hill Road.

11.6.165 Due to the small sample sizes (barbastelle were prioritised for tracking), i.e. two Natterer's bats (one in 2019, and one in 2021) and two Daubenton's bat (in 2021), the data collected through radio-tracking surveys reflects individual bats tracked rather than providing an overall picture of Natterer's bats and Daubenton's bat behaviour within the Site Boundary. This data is used in combination with ASD surveys to determine areas of *Myotis* activity.

11.6.166 Full results can be found in ES **Appendix 11.1: 2019 Radio-tracking Report** (Document Reference: 3.11.01), **Appendix 11.2: 2021 Radio-tracking Report** (Document Reference: 3.11.02) and **Appendix 11.4: 2021 Bat Activity Report** (Document Reference: 3.11.04).

11.6.167 A summary of the of the levels of *Myotis* activity within each broad habitat type recorded via automated detector surveys during summer 2019, 2020 and 2021, and winter 2020 / 2021 is detailed in **Table 11-22**.

11.6.168 Automated detector locations shown on **Figure 11.4, Appendix 11.10** (Document Reference: 3.11.10) (summer deployments) and **Figure 11.5, Appendix 11.10** (Document Reference: 3.11.10) (winter deployments), and locations of woodland names and features referred too are shown on **Figure 11.2, Appendix 11.10** (Document Reference: 3.11.10).

Table 11-22 Automated Detector Surveys – Summary of Results – Myotis

Broad Habitat Type	Summer / Winter	No. of Detectors (No of nights total)	Bat Activity Index Value (BAIV)	Peak Detector Activity (ppn) / ASD reference	Peak activity location
Grassland	Summer	8 (155)	7.01	14.3ppn (M51)	Grassland between Rose Carr and Spring Hill (within the Red Line Boundary, in the Compensation Extent)
Hedgerow	Summer	30 (701)	5.67	32.28ppn (C82)	Hedgerow north of Fakenham Road (within the Site Boundary)
Hedgerow	Winter	5 (175)	0.57	0.8ppn (C69)	Hedgerow along Ringland Lane (within the Site Boundary)
River	Summer	1 (25)	32.72	32.72ppn (C1)	River Wensum (within the Site Boundary)
River	Winter	1(35)	24.89	24.9ppn (C1)	River Wensum (within the Site Boundary)

Broad Habitat Type	Summer / Winter	No. of Detectors (No of nights total)	Bat Activity Index Value (BAIV)	Peak Detector Activity (ppn) / ASD reference	Peak activity location
Woodland	Summer	47 (1063)	5.75	24.76ppn (C61)	Rose Carr (outside the Site Boundary)
Woodland	Winter	8 (280)	3.81	8.9ppn (C73)	Nursery Woodland / Primrose Grove (within the Site Boundary)
Woodland edge	Winter	6 (210)	2.42	6.2ppn (C49)	Northern edge of Rose Carr (within the Red Line Boundary, in the Compensation Extent)

11.6.169 The activity levels of *Myotis* at each detector during the summer deployment is shown on **Figure 11.15, Appendix 11.10** (Document Reference: 3.11.10), with activity levels at each detector during the winter deployment shown on **Figure 11.16, Appendix 11.10** (Document Reference: 3.11.10).

11.6.170 The highest level of *Myotis* activity during both summer and winter surveys was recorded at C1, which was installed along the River Wensum within the Site Boundary. This *Myotis* activity is assumed to be from Daubenton's bats, that forage on insects close to the water / on the water surface (BCT, 2010b). During the winter period monitoring months, peaks in activity were recorded in October (49.20ppn) and April (109.40ppn), with lower activity recorded between November and March between (averages between 0.20ppn and 6.40ppn).

11.6.171 The highest levels of *Myotis* activity across all summer surveys at the Site Boundary following location C1, are detailed below, in order of activity:

- C82 recorded an average 32.28ppn, located within a hedgerow north of Fakenham Road within the Site Boundary, at the location of VP12;
- C61 recorded an average of 24.76ppn, located in woodland habitat at in Rose Carr outside the Site Boundary;
- C87 recorded an average 18.35ppn, located within a hedgerow south of Fakenham Road located outside of the Site Boundary;
- C15 recorded an average of 17.40ppn, located in woodland habitat within Foxburrow Plantation in the Site Boundary;
- C38 recorded an average of 14.04ppn, located woodland habitat at the Nursery Woodland / Rose Carr junction immediately north of the Site Boundary;
- M51 recorded an average of 14.33ppn, located in grassland habitat between Spring Hills and Rose Carr. This detector was at the northern end of VP2, within the Red Line Boundary in the Compensation Extent; and

- M50 recorded an average of 12.06ppn, located in grassland habitat north of Primrose Grove. M50 was installed within the Site Boundary, at the southern end of VP2.

11.6.172 Detector R5, which was installed within woodland in Spring Hill as part of the control group, recorded an average of 12.68ppn. This detector is located approximately 400 metres north-east of the Site Boundary. The highest levels of *Myotis* activity across all winter surveys in the Site Boundary, following Location C1, are detailed below, in order of activity:

- C73 recorded an average of 8.88ppn, located at Nursery Woodland / Primrose Grove junction, within the Site Boundary;
- C49 recorded an average of 6.17ppn, located on the northern edge of Rose Carr , within the Red Line Boundary in the Compensation Extent; and
- An average of 4.57ppn recorded within woodlands C74 within the Nursery Woodland / Rose Carr junction (immediately north of the Site Boundary), and 4.51ppn recorded at C75 Rose Carr (within Red Line Boundary, in the Compensation Extent).

11.6.173 All other detectors installed in woodlands or woodland edge habitats averaged less than 3.20ppn.

Overall Species Summary

11.6.174 *Myotis* were recorded at all survey locations within the Proposed Scheme. A number of areas of key importance for *Myotis* were identified through the surveys, which are detailed below in order of north to south.

11.6.175 Foraging habitat for *Myotis* was identified within the hedgerows north of Fakenham Road. From ASD surveys, the highest level of activity across all habitats was at C82, which was installed at VP12. Detectors C85, C86 and C87 also all recorded between 16.00 and 18.50ppn; higher than the remaining hedgerow detectors that all averaged less than 6.60ppn. C85 was located north of Fakenham Road, and C86 south of the A1076 at the location of VP10. CP87 was a hedgerow south of Fakenham Road, outside of the Site Boundary. During VP surveys at Fakenham Road:

- VP10 recorded a total of 18 bats observed crossing the road, with one bat foraging across the road. Of the bats observed crossing the road, 26.3% (five passes) crossed the road at a safe height;
- VP11 recorded six bats crossing the road; 83.3% (five passes) crossed the road at a safe height; and
- VP12 recorded six bats crossing the road; 50% (three passes) crossed the road at a safe height.

11.6.176 VP12 recorded a total of 47 Myotis passes across all surveys. Of these 47 passes – six were of a bat commuting across the road, four passes were of foraging bats, and the remaining 38 passes were heard but not seen. This indicates that Myotis are using this area to forage, with some bats crossing Fakenham Road. Myotis were also observed during the VP10, VP11 and VP12 foraging along the hedgerows and adjacent grassland habitats.

11.6.177 The River Wensum recorded the highest levels of Myotis activity during the summer months, and also recorded peaks of activity in October and April, during the transitional period before and after the core hibernation season.

11.6.178 One Natterer's bat transitional roost (ES66) and one Natterer's bat day roost (ES68) were recorded within Rose Carr outside of the Site Boundary. VP9, which is along a woodland ride running north to south through the eastern edge of the Nursery Woodland at the junction to Rose Carr, recorded the highest amount of Myotis activity of the VP surveys. Myotis were observed during the VP surveys using this woodland ride for both commuting and foraging. The Northern Woodlands also recorded the highest amount of Myotis activity in summer and winter for woodland habitats, and for woodland edges in winter. The grassland habitats between woodland blocks in the Northern Woodlands also recorded the highest amount of Myotis activity during summer surveys.

11.6.179 A hibernation roost of Daubenton's bat (ES52) is present within an underground bunker immediately to the north of Foxburrow Plantation. A second bunker supporting a *Myotis* hibernation roost (ES69) was identified approximately 330 metres north-east Foxburrow Plantation. *Myotis* was also recorded commuting along a woodland ride in Foxburrow Plantation and Foxburrow Stream during VP7 and VP8. During ASD surveys, the second highest activity levels in woodland habitats was recorded in Foxburrow Plantation.

Myotis Geographical Value

11.6.180 Whiskered bat (*Myotis mystacinus)* and Brandt's bat (*Myotis brandtii)* are considered rarer in East Anglia, and Alcathoe bat *Myotis alcathoe* is considered very rare (Reason, P.F. and Wray, S., 2023). No records of these *Myotis* species were returned from the desk study search detailed below. In addition, no records of these *Myotis* species have been identified during any surveys for the Proposed Scheme (included captures or through DNA analysis of droppings) or recorded during surveys undertaken for adjacent Schemes, which includes captures for radio-tracking or through DNA analysis of droppings. Whiskered bat, Brandt's bat and Alcathoe bat are therefore considered to be likely absent from the Site Boundary and not considered further.

11.6.181 The Proposed Scheme is also outside the known distribution of Bechstein's bat (*Myotis bechsteinii*), and this species is not considered further (JNCC, 2022a).

11.6.182 *Myotis* species fall under the legislative and policy protection being an EPS under the Habitats Regulations; and receiving protection under the WCA. Daubenton's bat is listed as the third most common species recorded in Norfolk, (NBAP, 2009b). No details on the abundance of Natterer's bat, which is included within the NBAP.

11.6.183 Natterer's bats are present throughout England, and it is considered that the population of Natterer's bat in England has increased since 1999 (BCT, 2023). Daubenton's bats are present throughout England, and the population of Daubenton's bat in England is considered to have been stable since 1999 (BCT, 2023).

11.6.184 Natterer's bat and Daubenton's bat are considered to be *widespread in many geographies, but not as abundant in all* (Reason, P.F. and Wray, S., 2023). Given this, the roosts within and adjacent to the Scheme fall under the following geographic value:

- Maternity colonies and roosts: Unlikely to exceed *County* importance unless colonies are atypically large
- Hibernation (small numbers): *Site.*
- Day roost: *Site*

11.6.185 Given the survey results, stable population and widespread distribution, a precautionary assessment of the population considers *Myotis* is assessed as being an Important Ecological Feature of County value.

Soprano Pipistrelle

Desk Study

11.6.186 The locations of roosts from the desk study records are presented on **Figure 11.17 Appendix 11.10** (Document Reference: 3.11.10).

11.6.187 No statutory or non-statutory designated sites for soprano pipistrelle were identified within the Study Area.

11.6.188 NBIS returned 99 records of soprano pipistrelle within the 3-kilometre Study Area (based on the CSZ for this species (BCT, 2023)) from within the last 10 years. Of these 89 records, ten were roost records:

- one roost in buildings located 1.1 kilometres north of the Site Boundary near Morton (assumed day roost – peak count of 1 individual);
- one roost in a church located 1.4 kilometres south of the Site Boundary near East Tuddenham (unspecified roost type);
- three day roosts located 1.8 kilometres, 2.1 kilometres and 2.3 kilometres south-east of the Site Boundary near to the A47;
- two maternity roosts in bat boxes located 1.8 kilometres and 2.4 kilometres south-east of the Site Boundary south of Taverham;
- one roost in a building 2.4 kilometres east of the Site Boundary near Hockering (unspecified roost type);
- one day roost 2.4 kilometres south of the Site Boundary, south of East Tuddenham; and
- one day roost in a church located 2.9 kilometres south-east of the Site Boundary near Easton

11.6.189 Twelve EPS licences have been granted for soprano pipistrelle within the 3-kilometre Study Area, with the closest recorded being destruction of a resting place located 485 metres north of the Site Boundary, near Morton.

11.6.190 Bat surveys undertaken by third parties as part of planning applications (Broadlands District Council) identified the following roosts within the 3-kilometre Study Area:

- destruction of a soprano pipistrelle day roost located 545 metres east of the Site Boundary (TORC Ecology, 2020, reference 20201450);
- destruction of a soprano pipistrelle day roost located 1.1 kilometres north of the Site Boundary (Wild Frontier Ecology, 2015, reference 20151771);
- destruction of two soprano pipistrelle day roosts located 1.3 kilometres north-west of the Site Boundary (MHE Consulting, 2017, reference 20200376); and
- destruction of a soprano pipistrelle day located 1.5 kilometres east of the Site Boundary (Insight Ecology, 2017, reference 20180481 / 20180525 / 20180540).

11.6.191 Bat boxes were installed as compensation for roost loss as part of the A1270 Broadland Northway. This included three boxes (1 – 3) approximately 90 metres to the north of the Site Boundary in Juniper woodland. A further three boxes (4 – 6) were installed within 500 metres west of the Site Boundary, at Fakenham Road in a woodland copse immediately north of the A1270 Broadland Northway. All other boxes installed for the A1270 Broadland Northway are located greater than 3 kilometres from the Site Boundary. During Year 1 monitoring in 2019, one soprano pipistrelle was recorded in Box 1, and pipistrelle droppings were recorded in Boxes 4 and 5 (Mott Macdonald, 2019a). During Year 3 monitoring in 2021, one soprano pipistrelle was recorded in Box 2, two soprano pipistrelles were recorded in Box 6, and one pipistrellus sp. In Box 3 (Mott Macdonald, 2021a).

Roost Identification

11.6.192 The locations of soprano pipistrelle roosts identified through the desk study, and roost identified through surveys undertaken for the Proposed Scheme, are presented on **Figure 11.19, Appendix 11.10** (Document Reference: 3.11.10). Survey data obtained for the Proposed Scheme has been reported across a number of different reports, which are included as Appendices that accompany the ES. Roosts have been renamed for this Chapter, to aid clarity due to the duplication of roost references. **Table 11-23** provides details of the ES roost reference and previous references used in the Appendix reports.

Tree Surveys

11.6.193 Tree surveys undertaken in summer identified 11 soprano pipistrelle day roosts. Four were identified during climbing inspections (ES71, ES72, ES75 and ES86), six during dusk surveys (ES74, ES80, ES81, ES82, ES84, ES85) and one during dawn surveys (ES73).

11.6.194 Back-tracking surveys undertaken in 2020 identified three day roosts (ES76, ES77 and ES83).

11.6.195 Of these 14 roosts, eight were located within the Northern Woodlands – two in the Nursery Woodland (ES72, ES75), five in Rose Carr (ES80, ES81, ES82, ES83, ES86), one in Spring Hills (ES84). Four roosts were located in Foxburrow Plantation (ES71, ES73, ES76, ES77), one in a hedgerow south of Foxburrow (ES85) and one in a hedgerow north of Weston Road (ES74).

11.6.196 Climbing surveys in winter identified one soprano pipistrelle hibernation roost – ES75; a single bat was recorded. This tree was also confirmed as a day roost and is located within the Nursery Woodland.

11.6.197 A second hibernation roost was identified in ES78 (Rose Carr), with a single Pipistrellus present within the tree (it was not possible to confirm the species without disturbing the bat). Likely a soprano or common pipistrelle; this roost has been assumed to support both species to inform the assessment.

11.6.198 During VP12 in 2022, a maternity roost was identified in a tree within the hedgerow being surveyed (ES79), within Site Boundary, to the north of Fakenham Road.

11.6.199 Full results can be found in ES **Appendix 11.3: 2021 Bat Roost Survey Report** (Document Reference: 3.11.03) and **Appendix 11.5: Summer Bat Report** (Document Reference: 3.11.05).

Structure Surveys

11.6.200 Structure surveys undertaken in summer identified three soprano pipistrelle day roosts in ES87, ES88 and ES89; all buildings present within the Site Boundary near the River Wensum.

11.6.201 No confirmed soprano pipistrelle hibernation roosts were identified within structures.

11.6.202 During hibernation surveys of structures, a single *pipistrellus* bat was recorded roosting within a church (ES94); it was not possible to confirm the species identification without disturbing the bat. Likely a soprano or common pipistrelle, . This roost has been assumed to support both species to inform the assessment.

11.6.203 Full results can be found in **ES Appendix 11.4: 2021 Bat Roost Survey Report** (Document Reference: 3.11.04).

Full Summary

11.6.204 Tree ES72, which supported a soprano pipistrelle day roost, was found fallen due to natural causes following completion of surveys. This tree is considered no longer suitable for roosting bats, and not included within the overall roost counts.

11.6.205 A total of 21 soprano pipistrelle roosts (19 confirmed and two assumed) across 20 trees and structures have been identified during surveys for the Proposed Scheme. These roosts are detailed within **Table 11-23**, and shown

on **Figure 11.17, Appendix 11.10** (Document Reference: 3.11.10). These 21 roosts comprise:

- one maternity roost;
- five hibernation roosts (two assumed); and
- 15 day roosts.

Table 11-23 Vantage Point Surveys – Summary of Results – Soprano Pipistrelle

Roost Ref (ES)	Appendix	Appendix Roost Ref	Status	Peak Count	Grid Reference	Tree or Structure	Distance
ES71	11.3	21	Day roost	3	TG 10658 13364	Tree	0m
ES72	11.3	39	Day roost	1	TG 13526 15286	Tree	Not applicable - Tree Fallen
ES73	11.3	58	Day roost	3	TG 10528 13435	Tree	0m
ES74	11.3	136	Day roost	1	TG 11721 14380	Tree	0m
ES75	11.3	41	Day and hibernation roost	3 (day) 1 (hib)	TG 13267 15238	Tree	0m
ES76	11.3	212	Day roost	1	TG 10598 13369	Tree	0m
ES77	11.3	220	Day roost	3	TG 10604 13382	Tree	0m
ES78	11.3	253	Hibernation (assumed)	1	TG 13408 15257	Tree	20m

Roost Ref (ES)	Appendix	Appendix Roost Ref	Status	Peak Count	Grid Reference	Tree or Structure	Distance
ES79	11.3	300	Maternity	25	TG 14528 15509	Tree	0m
ES80	11.3	38	Day roost	1	TG 13390 15321	Tree	70m
ES81	11.3	125	Day roost	2	TG 13452 15361	Tree	125m
ES82	11.3	127	Day roost	1	TG 13448 15356	Tree	125m
ES83	11.3	259	Day roost	1	TG 13442 15356	Tree	125m
ES84	11.3	345	Day roost	2	TG 13192 15378	Tree	105m
ES85	11.3	27	Day roost	1	TG 10473 13234	Tree	17m
ES86	11.3	257	Day roost	1	TG 13459 15237	Tree	15m
ES87	11.3	6A4	Day roost	1	TG 13783 15167	Structure	0m
ES88	11.3	6A2	Day roost	1	TG 13797 15185	Structure	0m
ES89	11.3	6A1	Day roost	1	TG 13818 15160	Structure	0m
ES94	11.3	All Saints Church	Hibernation (assumed)	1	TG 11338 15868	Structure	390m

Commuting and Foraging

Incidental Vantage Point Surveys

11.6.206 During VP surveys, soprano pipistrelle were incidentally recorded commuting and foraging. Records of soprano pipistrelle were recorded at all VP locations, with behaviour activity noted at the following locations:

- Commuting in both directions along the woodland ride, and foraging within the woodland ride in the Nursery Woodland (VP1 and VP9);
- Commuting across the grassland strip between Nursery Woodland and Spring Hill (VP2);
- Commuting north to south along the woodland edge at Long Plantation (VP3);
- Commuting along the hedgerow at Ringland Lane (VP4);
- Commuting in both directions at the hedgerow north of Weston Road (VP5). Continuous foraging activity for the duration of the survey was also recorded during a VP survey in August 2020;
- Foraging along the Broadway (VP6), with a VP survey in June 2020 and July 2020 recorded continuous foraging activity during the survey;
- Foraging recorded within a woodland ride within Foxburrow Plantation (VP7) and foraging along the woodland adjacent to Foxburrow Stream (VP8). Soprano pipistrelles were also recorded commuting in both directions along the woodland ride (VP7);
- Foraging recorded at a hedgerow north of Fakenham Road (VP10), with constant foraging activity during a survey in August 2022. Soprano pipistrelles were also recorded commuting across Fakenham Road; and
- Foraging and commuting recorded at a hedgerow north of Fakenham Road (VP12), associated with a roost being identified during the VP surveys (detailed in **paragraph 11.6.198)**.

Automated Static Detectors

11.6.207 A summary of the levels of soprano pipistrelle activity within each broad habitat type recorded via automated detector surveys during summer 2019, 2020 and 2021, and winter 2020 / 2021 is detailed in **Table 11-24**.

11.6.208 Automated detector locations shown on **Figure 11.4, Appendix 11.10** (Document Reference: 3.11.10) (summer deployments) and **Figure 11.5, Appendix 11.10** (Document Reference: 3.11.10) (winter deployments), and locations of woodland names and features referred to are shown on **Figure 11.2, Appendix 11.10** (Document Reference: 3.11.10).

Table 11-24 Automated Detector Surveys – Summary of Results – Soprano Pipistrelle

Broad Habitat Type	Summer / Winter	No. of Detectors (No of nights total)	Bat Activity Index Value (BAIV)	Peak Detector Activity (ppn) / ASD reference	Peak Activity Location
Grassland	Summer	8 (155)	39.44	96.96ppn (D1)	Grassland located near WC5 / east of Rose Carr (within Site Boundary)
Hedgerow	Summer	30 (701)	49.39	223.24ppn (C82)	Hedgerow north of Fakenham Road (within the Site Boundary)
Hedgerow	Winter	5 (175)	9.01	24.88ppn (C65)	Breck Lane (Breck Road) (within Site Boundary)
River	Summer	1 (25)	517.92	517.92ppn (C1)	River Wensum (within the Site Boundary)
River	Winter	1(35)	43.66	43.65ppn (C1)	River Wensum (within the Site Boundary)
Woodland	Summer	47 (1063)	187.81	704.77ppn (C15i)	Foxburrow Plantation (within the Site Boundary)

Broad Habitat Type	Summer / Winter	No. of Detectors (No of nights total)	Bat Activity Index Value (BAIV)	Peak Detector Activity (ppn) / ASD reference	Peak Activity Location
Woodland	Winter	8 (280)	57.25	197.71ppn (C75)	Rose Carr (within Red Line Boundary, in the Compensation Extent)
Woodland edge	Winter	6 (210)	60.50	144.17ppn (C70)	Northern edge of Long Plantation (within the Site Boundary)

11.6.209 The activity levels of soprano pipistrelle at each detector during the summer deployment is shown on **Figure 11.18, Appendix 11.10** (Document Reference: 3.11.10), with activity levels at each detector during the winter deployment shown on **Figure 11.19, Appendix 11.10** (Document Reference: 3.11.10).

11.6.210 The highest level of soprano pipistrelle activity across all detectors during the summer surveys was recorded within woodland habitat. Activity levels, in order of activity, in the Site Boundary are detailed below:

- C15i recorded an average of 704.77ppn, and C15 recorded 675.00ppn located in woodland habitat at Foxburrow Plantation within the Site Boundary (in close proximity to VP7);
- C61 recorded an average of 545.36ppn in Rose Carr, outside the Site Boundary;
- C42 recorded an average of 539.00ppn, located in woodland habitat Foxburrow Plantation within the Site Boundary;
- C82 recorded an average of 223.24ppn at a hedgerow to the north of Fakenham Road (at the location of VP12) that falls within the Site Boundary;
- C85 recorded an average of 166.05ppn, and C87 recorded an average of 151.15ppn. C85 was installed along a hedgerow partially within the Site Boundary north of Fakenham Road at the location of VP10, and C87 was installed in hedgerows outside the Site Boundary south of Fakenham Road;
- D1 recorded an average of 96.96ppn within grassland adjacent WC5 / east of Rose Carr, located within Site Boundary; and
- M51 recorded an average of 66.26ppn in grassland habitat between Spring Hills and Rose Carr. This detector was at VP2, within the Red Line Boundary in the Compensation Extent.

11.6.211 R5, which was installed within woodland in Spring Hill as part of the control group, recorded an average of 686.36ppn. This detector is located approximately 375 metres north-east of the Site Boundary.

11.6.212 High levels of soprano pipistrelle activity during summer were recorded at the River Wensum (C1) within the Site Boundary, with an average of 517.92ppn. Soprano pipistrelles usually feed in wetland habitats, therefore the peak of activity in this location is likely in relation to foraging activity (BCT, 2010c). During the winter months, an average of 43.65ppn was recorded at C1. A peak in activity was recorded in October (272.20ppn) with less activity recorded between November and April (between 0 and 21.60ppn).

11.6.213 During winter months, as expected lower levels of activity were recorded, with winter peaks recorded within woodland habitats. Winter activity levels, in order of activity, in the Site Boundary are detailed below:

- C75 recorded averaged 197.71ppn, with a peak of activity was recorded at this detector in November with 1040.20ppn recorded. This detector was located at Rose Carr within the Red Line Boundary, in the Compensation Extent;
- C70 recorded an average 144.17ppn, within woodland edge habitat on the eastern edge of Long Plantation within the Site Boundary;
- C21 recorded an average of 122.80ppn, installed along the Broadway along VP6 (within the Site Boundary) and
- C74 recorded an average of 100.31ppn, C72 recorded an average of 87.91ppn and C73 recorded an average 48.88ppn. All detectors were installed within woodland habitat within the Northern Woodlands – C72 in Spring Hills (within the Red Line Boundary in the Compensation Extent), C73 at Nursery Woodland / Primrose Grove junction within the Site Boundary, and C74 at the immediately north of the Site Boundary in Rose Carr.

Overall Species Summary

11.6.214 Soprano pipistrelles were recorded at all survey locations within the Site Boundary. A number of areas of key importance for soprano pipistrelle were identified through the surveys which are detailed below in order of north to south.

11.6.215 A hedgerow north of Fakenham Road recorded the highest activity levels for this habitat type, with an average of 232ppn at C82. This hedgerow was at the location of VP12, where a maternity roost was identified after surveys commenced in this location. Soprano pipistrelle were also incidentally recorded commuting and foraging along and surrounding the hedgerow during VP12. C85 and C87 were installed at hedgerows where VP10 was undertaken, with C85 north of Fakenham Road and C87 south of Fakenham Road. C85 recorded an average of 166ppn, and C87 an average of 151ppn. Incidental records of commuting and foraging soprano pipistrelles were also made during VP10. These hedgerows fall partially within the Site Boundary, and the maternity roost is within the Site Boundary.

11.6.216 The River Wensum recorded high levels of soprano pipistrelle activity during the summer months, with the highest level of soprano pipistrelle activity recorded across all months of survey located at the River Wensum in August, with a peak of 1352ppn. VP surveys undertaken in 2019 recorded at least two soprano pipistrelles commuting east to west along the river, with up to ten bats recorded foraging. During winter, a peak in activity of 272ppn was recorded in October during the transitional period before the core hibernation season. The remaining months of winter surveys (November to April) recorded an average between 0 and 22ppn.

11.6.217 A total of eight roosts across seven trees have been recorded within the Northern Woodland complex. Of these roosts, six are days roosts (ES38, ES81, ES82, ES83, ES84, ES86) in Rose Carr and Spring Hills that fall outside of the Site Boundary. Two roosts, a day roost and hibernation roost, were identified in ES75. This tree is within the Nursery Woodland, within the Site Boundary. Within the area of the Nursery Woodland that falls within the

Site Boundary, three detectors were installed along VP1 and VP9. Averages of 169ppn, 410ppn and 539ppn recorded across the summer surveys at these locations. Incidental records of soprano pipistrelle foraging within the woodland ride at Nursery Woodland, and commuting in both directions along this road, were recorded during VP1 and VP9.

11.6.218 The Northern Woodlands recorded high levels of foraging activity during summer, with peaks of up to 1016ppn in Spring Hills in September, and 792ppn in Rose Carr in August. Both these locations fall outside of the Site Boundary. The highest activity within winter surveys was 197.71ppn, recorded at C75 in Rose Carr, with peaks of 1040.20ppn recorded in November. Peaks of activity during winter surveys were also recorded within Spring Hills, with a peak of 371.40ppn in October. A peak of 516.80ppn was recorded also in October, at C74 installed in Rose Carr, and a peak of 262.80ppn was recorded in October at the Nursery Woodland / Primrose Grove junction. At Long Plantation, C70 along the woodland edge recorded a peak of 373.00ppn in October, and 618.20ppn in November. The high levels of activity in October and November suggest that these woodland blocks provide a foraging resource during the transitional period prior to hibernation.

11.6.219 Four soprano pipistrelle day roosts have been recorded within Foxburrow Plantation (ES71, ES73, ES76, ES77) that fall within the Site Boundary. One additional day roost within an isolated tree in a hedgerow south of Foxburrow Plantation (ES85) was recorded, which falls outside the Site Boundary. High levels of activity were recorded in Foxburrow Plantation during the summer months at a number of detectors. This includes at static detectors installed along VP7, with an average of 704.77ppn and 675.00ppn recorded during the summer months. Incidental records of soprano pipistrelle were recorded during VP7 and VP8, with foraging recorded within the woodland ride at VP7, and foraging within the woodland adjacent to Foxburrow Stream. Soprano pipistrelles were also incidentally recorded commuting in both directions along the woodland ride during VP7.

Soprano Pipistrelle Geographical Value

11.6.220 Soprano pipistrelle fall under legislative and policy protection, including being an EPS of the Habitats Regulations; and receiving protection under the WCA. Soprano pipistrelles are identified as a SPI (Section 41 of the NERC Act, 2006). Within Norfolk, soprano pipistrelle is included as a priority species on the NBAP and are listed as being 'under recorded' (NBAP, 2009b).

11.6.221 The soprano pipistrelle population in England is considered to have been stable since 1999 (BCT, 2023).

11.6.222 Soprano pipistrelles are considered to be widespread in all geographies (Reason, P.F. and Wray, S., 2023). Given this, the roosts within and adjacent to Scheme fall under the following geographic value:

- Maternity colonies and roosts: *District*.
- Hibernation (small numbers): *Site*.
- Day roost: *Site*

11.6.223 Given the survey results, stable population and widespread distribution, soprano pipistrelle is assessed as being an Important Ecological Feature of District value.

Common Pipistrelle

Desk Study

11.6.224 The locations of roosts from the desk study records are presented on **Figure 11.20, Appendix 11.10** (Document Reference: 3.11.10).

11.6.225 No statutory or non-statutory designated sites for common pipistrelle were identified within the Study Area.

11.6.226 NBIS returned 67 records of common pipistrelle within the 2-kilometre Study Area (based on the CSZ of this species (BCT, 2023)) from within the last ten years. Of these 67 records, five were roost records which are summarised below:

- one roost in building located 1.1 kilometres north of the Site Boundary near Morton (assumed day roost – peak count of one individual on one survey, and a peak count of two individuals on a second survey);
- one unspecified in a building located 515 metres west of the Site Boundary Scheme (dead bat found);
- one maternity roost in a building located 1.6 kilometres south-east of the Site Boundary near Taverham;
- one roost in a church located 1.4 kilometres south of the Site Boundary, near East Tuddenham (assumed day roost due to a peak count of one bat); and
- one day roost in a church located 1.8 kilometres south-east of the Site Boundary north of the A47.

11.6.227 Eight EPS licences have been granted for common pipistrelle within the 2-kilometre Study Area, with the closest recorded being destruction of a resting place located 485 metres north of the Site Boundary near Morton.

11.6.228 Bat surveys undertaken by third parties as part of planning applications (Broadlands District Council) identified the following roosts within the 2kilometre Study Area which are summarised below:

- destruction of a common pipistrelle day roost located 545 metres east of the Site Boundary (TORC Ecology, 2020, reference 20201450);
- destruction of a common pipistrelle day roost located 1.1 kilometres north of the Site Boundary (Wild Frontier Ecology, 2015, reference 20151771);
- destruction of four common pipistrelle day roosts located 1.3 kilometres north-west of the Site Boundary (MHE Consulting, 2017, reference 20200376); and

- destruction of a common pipistrelle day roosts located 1.5 kilometres east of the Site Boundary (Insight Ecology, 2017, reference 20180481 / 20180525 / 20180540).

11.6.229 Bat boxes were installed as compensation for roost loss as part of the A1270 Broadland Northway. This included three boxes (1 – 3) approximately 90 metres to the north of the Site Boundary in Juniper woodland. A further three boxes (4 – 6) were located 500 metres west of the Site Boundary at Fakenham Road in a woodland copse immediately north of the A1270 Broadland Northway. All other boxes installed for the A1270 Broadland Northway are located greater than 2 kilometres from the Site Boundary. During Year 1 monitoring (2019), pipistrelle droppings were recorded in box 4 and 5 (Mott Macdonald, 2019a). During Year 3 (2021), one pipistrelle (species unconfirmed) was recorded in Box 3 (Mott Macdonald, 2021a), with three common pipistrelles recorded in Box 3 in Year 5 (Mott Macdonald, 2023).

11.6.230 Post-construction monitoring was undertaken of the building located 70m north-east of the Site Boundary at Fakenham Road (a retained brown long-eared bat maternity roost). During Year 3 monitoring (2021), two common pipistrelles were recorded during the dusk emergence / dawn re-entry surveys (Mott Macdonald, 2021a).

Roost Identification

11.6.231 The locations of common pipistrelle roosts identified through the desk study, and roosts identified through surveys undertaken for the Proposed Scheme, are presented on **Figure 11.20, Appendix 11.10** (Document Reference: 3.11.10). Survey data obtained for the Proposed Scheme has been reported across a number of different reports, which are included as Appendices that accompany the ES. Roosts have been renamed for this Chapter, to aid clarity due to the duplication of roost references. **Table 11-25** provides details of the ES roost reference and previous references used in the Appendix reports.

Tree Surveys

11.6.232 Tree surveys undertaken in summer identified four common pipistrelle day roosts. Two were identified during climbing inspections (ES90 and ES91) and two during dusk surveys (ES92 and ES93). Of these roosts, one is located within Primrose Grove (ES90), one is located within Gravelpit Plantation and two are located along a hedgerow along Weston Road (ES92 and ES93).

11.6.233 Hibernation climbing surveys identified a roost with a single *Pipistrellus* bat present within the tree (ES78); it was not possible to confirm the species identification without disturbing the bat. Due to the size of the bat present, it is likely a soprano or common pipistrelle. This roost has been assumed to support both species to inform this assessment. This roost is located within Rose Carr.

11.6.234 Full results can be found in ES **Appendix 11.3: 2021 Bat Roost Survey Report** (Document Reference: 3.11.03).

Structure Surveys

11.6.235 Structure surveys undertaken in summer identified six common pipistrelle day roosts in Buildings ES55, ES87, ES88, ES89, ES95 and ES96. Three of the buildings are located adjacent to the Site Boundary along Weston Road (ES55, ES95 and ES96) and three are within the Site Boundary near the River Wensum (ES87, ES88 and ES89)

11.6.236 No confirmed common pipistrelle hibernation roosts were identified within structures.

11.6.237 During hibernation surveys of structures, a single pipistrelle was recorded roosting within a church (ES94); it was not possible to confirm the species identification without disturbing the bat. Due to the size of the bat present, it is likely a soprano or common pipistrelle. This roost has been assumed to support both species to inform this assessment.

11.6.238 Full results can be found in ES **Appendix 11.4: 2021 Bat Roost Survey Report** (Document Reference: 3.11.04).

Full Summary

11.6.239 A total of 12 common pipistrelle roosts (ten confirmed and two assumed) have been identified during surveys for the Proposed Scheme, which are detailed within **Table 11-25**, and shown on **Figure 11.20, Appendix 11.10** (Document Reference: 3.11.10). These 12 roosts comprise:

- two hibernation roosts (both assumed); and
- ten day roosts.

Table 11-25 Common Pipistrelle Roost Summary

Roost Ref (ES)	Appendix	Appendix Roost Ref	Status	Peak Count	Grid Reference	Tree or Structure	Distance from the Site Boundary
ES90	11.3	69	Day roost	1	TG 13133 15171	Tree	0m
ES91	11.3	105	Day roost	3	TG 12415 14992	Tree	0m
ES92	11.3	138	Day roost	2	TG 11539 14536	Tree	0m
ES93	11.3	139	Day roost	1	TG 11527 14558	Tree	0m
ES55	11.3	8A1	Day roost	1	TG 11456 14622	Structure	40m
ES87	11.3	6A4	Day roost	1	TG 13783 15167	Structure	0m
ES88	11.3	6A2	Day roost	1	TG 13797 15185	Structure	0m
ES89	11.3	6A1	Day roost	1	TG 13818 15160	Structure	0m
ES95	11.3	7B2	Day roost	1	TG 11495 14588	Structure	9m
ES96	11.3	7B1	Day roost	1	TG 11479 14584	Structure	20m
ES78	11.3	253	Hibernation (assumed)	1	TG 13408 15257	Tree	20m

Roost Ref (ES)	Appendix	Appendix Roost Ref	Status	Peak Count	Grid Reference	Tree or Structure	Distance from the Site Boundary
ES94	11.3	All Saints Church	Hibernation (assumed)	1	TG 11338 15868	Structure	390m

Commuting and Foraging

Incidental Vantage Point Surveys

11.6.240 During VP surveys, common pipistrelle were incidentally recorded commuting and foraging. Records of common pipistrelle were recorded at all VP locations, with the following noted:

- commuting in both directions along the woodland ride, and foraging within the woodland ride, surveyed at VP1 and VP9 in the Nursery Woodland;
- commuting in between Rose Carr / Nursery Woodland and Spring Hills across grassland (VP2);
- commuting along the woodland edge at Long Plantation (VP3);
- commuting in both directions at the hedgerow north of Weston Road (VP5). continuous foraging activity for the duration of the survey was also recorded during a VP survey in June 2020 within the field edge and hedgerow;
- foraging and commuting along the Broadway (VP6);
- commuting along both directions, and foraging within a woodland ride in Foxburrow Plantation (VP7);
- foraging at meadow north of the Foxburrow Stream (VP8); and
- foraging and commuting recorded at a woodland copse surveyed at VP11, and foraging along at hedgerow at VP12, both located north of Fakenham Road.

Automated Static Detectors

11.6.241 A summary of the of the levels of common pipistrelle activity within each broad habitat type recorded via automated detector surveys during summer 2019, 2020 and 2021, and winter 2020 / 2021 is detailed in **Table 11-26**.

11.6.242 Automated detector locations shown on **Figure 11.4, Appendix 11.10** (Document Reference: 3.11.10) (summer deployments) and **Figure 11.5, Appendix 11.10** (Document Reference: 3.11.10) (winter deployments), and locations of woodland names and features referred too are shown on **Figure 11.2, Appendix 11.10** (Document Reference: 3.11.10).

Table 11-26 Automated Detector Surveys – Summary of Results – Common Pipistrelle

Broad Habitat Type	Summer / Winter	No. of Detectors (No of nights total)	Bat Activity Index Value (BAIV)	Peak Detector Activity (ppn) / ASD reference	Peak Activity Location
Grassland	Summer	8 (155)	34.62	89.13ppn (M51)	Grassland between Rose Carr and Spring Hill (within the Red Line Boundary in the Compensation Extent)
Hedgerow	Summer	30 (701)	95.31	432.50ppn (C85)	Hedgerow north of Fakenham Road (outside the Site Boundary)
Hedgerow	Winter	5 (175)	12.09	31.20ppn (C67)	Hedgerow along of Weston Road (within the Site Boundary)
River	Summer	1 (25)	77.44	77.44ppn (C1)	River Wensum (within the Site Boundary)

Broad Habitat Type	Summer / Winter	No. of Detectors (No of nights total)	Bat Activity Index Value (BAIV)	Peak Detector Activity (ppn) / ASD reference	Peak Activity Location
River	Winter	1(35)	6.23	6.23ppn (C1)	River Wensum (within the Site Boundary)
Woodland	Summer	47 (1063)	277.57	1025.20ppn (C41)	Foxburrow Plantation (within Site Boundary)
Woodland	Winter	8 (280)	20.16	66.37ppn (C72)	Spring Hills (within Red Line Boundary in the Compensation Extent)
Woodland edge	Winter	6 (210)	50.80	112.03ppn (C70)	Northern edge of Long Plantation (within the Site Boundary)

11.6.243 The activity levels of common pipistrelle at each detector during the summer deployment is shown on **Figure 11.21, Appendix 11.10** (Document Reference: 3.11.10), with activity levels at each detector during the winter deployment shown on **Figure 11.22, Appendix 11.10** (Document Reference: 3.11.10).

11.6.244 The highest level of common pipistrelle activity across all detectors during the summer surveys was recorded within woodland habitat. Activity levels, in order of activity, in the Site Boundary are detailed below:

- C41 recorded an average of 1025.20ppn, located in woodland habitat Foxburrow Plantation within the Site Boundary;

- C15i recorded an average of 1010.10ppn, located in woodland habitat Foxburrow Plantation within the Site Boundary, in close proximity to VP7;
- C53 recorded an average of 967.92ppn, located in woodland habitat at Long Plantation within the Site Boundary;
- C85 recorded an average of 432.50ppn, located along a hedgerow partially within the Site Boundary, north of Fakenham Road at the location of VP10;
- B8 recorded an average of 279.20ppn, located at a hedgerow to the north of Weston Road outside of the Site Boundary. This hedgerow however is connected to the hedgerows surveyed in VP5;
- M51 recorded an average of 89.13ppn, located in grassland habitat between Spring Hills and Rose Carr. This detector was at the northern end of VP2, within the Red Line Boundary in the Compensation Extent; and
- M43 recorded an average of 67.05ppn, located in grassland located near water course 5 (WC5) to the East of Rose Carr, within the Site Boundary.

11.6.245 Along the River Wensum at C1, an average of 77.44ppn were recorded during the summer surveys, with an average of 6.23ppn recorded during the winter surveys.

11.6.246 During winter months, the peak activity recorded was within woodland edge. Winter activity levels, in order of activity, in the Site Boundary are detailed below:

- C70 recorded an average 112.03ppn, within woodland edge habitat on the eastern edge of Long Plantation within the Site Boundary;
- C21 recorded an average of 92.42ppn, installed along the Broadway along VP6 (within the Site Boundary);

- C72 recorded an average of 66.37ppn, and C74 recorded an average of 23.37ppn within woodland habitats in the Northern Woodlands. C72 was in Spring Hills within the Red Line Boundary in the Compensation Extent, and C74 in Rose Carr immediately north of the Site Boundary;
- C67 recorded an average of 31.20ppn, within a hedgerow located along Weston Road within the Site Boundary; and
- C11 recorded an average of 21.62ppn, located in a hedgerow north of the Weston Road where VP5 was undertaken, within the Site Boundary.

Overall Species Summary

11.6.247 Common pipistrelles were recorded at all survey locations within the Site Boundary. A number of areas of particular importance for common pipistrelle were identified through the surveys, which are detailed below in order of north to south.

11.6.248 One common pipistrelle day roost is present on the edge of Primrose Grove (ES90), with a cluster of day roosts in buildings present 265 metres east (ES87, ES88 and ES89). WC5 provides a connecting habitat between these buildings and the Northern Woodlands. The Northern Woodlands are also considered to be a key area for common pipistrelle, with highest levels of activity recorded of all habitat types during the winter months. Incidental records of commuting and foraging were recorded along a woodland ride in the Nursery Woodland during VP1 and VP9. The grasslands present between these woodlands also recorded the highest amount of activity within the grassland habitats during the summer surveys.

11.6.249 A cluster of common pipistrelle day roosts are located along Weston Road, with a total of three day roosts in buildings (ES55, ES95 and ES96) and two day roosts in trees (ES92 and ES93). During summer automated static monitoring surveys, the hedgerow immediately north of the three building roosts recorded 279ppn at B78, with a peak of 1396ppn recorded in May. At the hedgerow north of Weston Road surveyed at VP5, incidental records of

common pipistrelle were recorded commuting in both directions along the hedgerow. Incidental records of foraging were also recorded, both along the hedgerow and within the field edge habitat. During winter surveys, an ASD immediately adjacent to the two day roosts in trees (C67) recorded an average of 31.2ppn in winter, and C11 to the north-west of these roosts at the location of VP5 recorded an average of 21.6ppn in winter.

11.6.250 Foxburrow Plantation recorded the highest level of common pipistrelle activity during the summer surveys across a number of detectors installed within this woodland. This included detectors installed along VP7, a woodland ride within Foxburrow, and VP8 which is along Foxburrow Stream. During VP7, incidental records of common pipistrelle commuting in both directions, and foraging within, a woodland ride in Foxburrow Plantation were recorded. During VP8 at Foxburrow Stream, incidental records of foraging were recorded within a meadow north of the stream.

Common Pipistrelle Geographical Value

11.6.251 Common pipistrelle fall under legislative and policy protection, including being an EPS of the Habitats Regulations; and receiving protection under the WCA. On the NBAP, common pipistrelle is listed as the most frequently recorded bat in Norfolk (NBAP, 2009b).

11.6.252 The population of common pipistrelle in England is considered to have increased since 1999 (BCT, 2023).

11.6.253 Common pipistrelle is considered to be widespread in all geographies (Reason, P.F. and Wray, S., 2023). Given this, the roosts within and adjacent to Scheme fall under the following geographic value:

- Hibernation (small numbers): *Site*.
- Day roost: *Site*

11.6.254 Given the survey results, the stable population, and its widespread distribution, common pipistrelle is assessed as being an Important Ecological Feature of Site value.

Nathusius' Pipistrelle

Desk Study

11.6.255 The locations of roosts from the desk study records are presented on **Figure 11.23, Appendix 11.10** (Document Reference: 3.11.10).

11.6.256 No statutory or non-statutory designated sites for Nathusius' pipistrelle were identified within the Study Area.

11.6.257 A review of historic radio-tracking data was undertaken, as detailed in **Section 11.5.18**, which returned one roost record within the 3-kilometre Study Area (based on the CSZ for this species (BCT, 2023)). This was day roost in a tree located 3 kilometres north of the Site Boundary, near Felthorpe. This roost was identified through the radio-tracking of a male Nathusius' pipistrelle in 2009.

11.6.258 NBIS returned two records of Nathusius' pipistrelle within the 3-kilometre Study Area from within the last ten years. This was of audio-records, with no roosts returned.

11.6.259 No EPS licences were identified for Nathusius' pipistrelle within the 3 kilometre Study Area.

11.6.260 No Nathusius' pipistrelle roosts have been identified by third parties as part of planning applications within the 3-kilometre Study Area.

Roost Identification

11.6.261 No Nathusius' pipistrelle were caught during bat trapping surveys in 2019 and 2021 for the Proposed Scheme.

11.6.262 No Nathusius' pipistrelle roosts were identified in trees or structures during surveys for the Proposed Scheme.

Commuting and Foraging

Incidental Vantage Point Surveys

11.6.263 During VP surveys, Nathusius' pipistrelle passes were incidentally recorded at VP5 located at the hedgerow north of Weston Road, and at VP7 within Foxburrow Plantation. No details of the behaviour were noted.

Automated Static Detectors

11.6.264 A summary of the levels of Nathusius' pipistrelle activity within each broad habitat type recorded via automated detector surveys during summer 2019, 2020 and 2021, and winter 2020 / 2021 is detailed in **Table 11-27**.

11.6.265 Automated detector locations shown on **Figure 11.4, Appendix 11.10** (Document Reference: 3.11.10) (summer deployments) and **Figure 11.5, Appendix 11.10** (Document Reference: 3.11.10) (winter deployments), and locations of woodland names and features referred too are shown on **Figure 11.2, Appendix 11.10** (Document Reference: 3.11.10).

Table 11-27 Automated Detector Surveys – Summary of Results – Nathusius' Pipistrelle

Broad Habitat Type	Summer / Winter	No. of Detectors (No of nights total)	Bat Activity Index Value (BAIV)	Peak Detector Activity (ppn) / ASD reference	Peak Activity Location
Grassland	Summer	8 (155)	0.30	0.86ppn (M46)	Grassland between Long Plantation and Spring Hill (outside the Site Boundary)
Hedgerow	Summer	30 (701)	1.29	29.20ppn (B8)	Hedgerow adjacent to Weston Road (outside the Site Boundary)

Broad Habitat Type	Summer / Winter	No. of Detectors (No of nights total)	Bat Activity Index Value (BAIV)	Peak Detector Activity (ppn) / ASD reference	Peak Activity Location
Hedgerow	Winter	5 (175)	0.01	0.29ppn (C65 and C67)	C65: Hedgerow along of Weston Road (within the Site Boundary) C67: Hedgerow along Breck Road (within the Site Boundary)
River	Summer	1 (25)	0.20	0.20ppn (C1)	River Wensum (within the Site Boundary)
River	Winter	1 (35)	0.00	0.00	Not applicable
Woodland	Summer	47 (1063)	1.17	52.20ppn (C15)	Foxburrow Plantation (within the Site Boundary
Woodland	Winter	8 (280)	0.00	0.00	Not applicable
Woodland edge	Winter	6 (210)	0.00	0.29ppn (C21)	The Broadway (within the Site Boundary)

11.6.266 The highest level of Nathusius' pipistrelle activity across all detectors during the summer surveys was recorded within woodland habitat. Activity levels, in order of activity, in the Site Boundary are detailed below:

- C15 recorded an average of 52.20ppn, located in woodland habitat Foxburrow Plantation within the Site Boundary, in close proximity to VP7;

- B8 recorded an average of 29.20ppn, located at a hedgerow to the north of Weston Road outside of the Site Boundary. This hedgerow however is connected to the hedgerows surveyed in VP5; and
- C12 recorded an average of 10.68ppn, located south of Weston Road immediately adjacent to the Site Boundary Scheme; and
- C11 recorded an average 8.16ppn, located in a hedgerow north of the Weston Road where VP5 was undertaken, within the Site Boundary.

11.6.267 Low levels of activity were also recorded in grassland habitats with all sites having an average of less than 1ppn during summer surveys.

11.6.268 The River Wensum recorded low levels of activity, with an average of 0.2ppn recorded in summer, and no passes in winter surveys.

11.6.269 During winter surveys, only three locations across all habitats recorded activity. This was an average of 0.3ppn recorded at C21, C65 and C7. C21 was installed along the Broadway, C65 was installed at a hedgerow along Weston Road and C67 was installed at a hedgerow along Breck Road. All locations were within the Site Boundary.

11.6.270 Activity data was reviewed for activity peaks in Spring (March / April), and Autumn (September / October), which may have indicated Nathusius' pipistrelle migration across the Site Boundary. There was no indication of increases in activity during the Spring and Autumn period. Peaks in activity for Nathusius' pipistrelle were recorded during May, June, and July.

Overall Species Summary

11.6.271 Nathusius' pipistrelle is higher flying species, with flight heights averaging between 4 and 15 metres above ground (Russ, 2021). Within the hedgerows surrounding Weston Road, a number of detectors recorded Nathusius' pipistrelle, including incidental passes recorded during VP5.

11.6.272 Foxburrow Plantation recorded the highest amount of activity across the different habitats; however, this was a peak of 52.20ppn recorded in June, and 14.20ppn in August. All other statics in Foxburrow Plantation recorded

between 0 and 9.00ppn. Passes of Nathusius' pipistrelle was also recorded incidentally during VP7, located at a woodland ride within Foxburrow Plantation.

11.6.273 All remaining statics recorded an average of less than 6.00ppn within woodland habitats in summer. During winter, three statics recorded 0.29ppn, with all remaining statics recording no activity.

Nathusius' Pipistrelle Geographical Value

11.6.274 Nathusius' pipistrelle falls under legislative and policy protection, including being an EPS of the Habitats Regulations; and receiving protection under the WCA. On the NBAP, Nathusius' pipistrelle is listed as the rarest breeding bat in Norfolk (NBAP, 2009b).

11.6.275 Nathusius' pipistrelles have a scattered distribution across England, with a greater distribution within the south of England, including East Anglia (Mathews *et al.*, 2018). There is insufficient data for Nathusius' pipistrelle to detect any changes in population trends (BCT, 2023).

11.6.276 No Nathusius' pipistrelle roosts were recorded as part of the Proposed Scheme survey effort. However, within the rarity categorisation table of the BMG, Nathusius' pipistrelle is considered to be within the rarer / restricted distribution category (Reason, P.F. and Wray, S., 2023).

11.6.277 Given the survey results, in the form of lack of recorded roosts and lower levels of activity recorded, Nathusius' pipistrelles are assessed as being an Important Ecological Feature of Site value.

Noctules, Leisler's Bat and Serotine

Desk Study

11.6.278 The locations of roosts from the desk study records are presented on **Figure 11.24, Appendix 11.10** (Document Reference: 3.11.10).

11.6.279 No statutory or non-statutory designated sites for noctule, Leisler's bat or serotine were identified within the Study Area.

11.6.280 A review of historic radio-tracking data was undertaken, as detailed in **Section 11.5.18**, returned no records of noctule, Leisler's bat or serotine within the 4-kilometre Study Area.

11.6.281 NBIS returned 80 records of noctule within the 4-kilometre Study Area (based on the CSZ of this species (BCT, 2023)) from within the last ten years. All records returned were audio-records, with no roosts returned. One record was present from within the Site Boundary, which was a single post-lactating female caught in a mist-net within the Nursery Woodland (location is accurate to 0.3 kilometres from the grid reference provided).

11.6.282 NBIS returned 37 records of serotine within the 4-kilometre Study Area (based on the CSZ of this species (BCT, 2023)) from within the last ten years. Of these records, one was of a roost, with all other records from audio detectors. This roost was a possible serotine recorded hibernating in disused WWII command bunker, 440 metres north-west of the Site Boundary at Breck Road.

11.6.283 NBIS returned a single record of Leisler's bat within the 3-kilometre Study Area (based on the CSZ of this species (BCT, 2023)) from within the last ten years. This was of an audio-record, with no roosts returned.

11.6.284 Two EPS licences have been granted for noctule within the 4-kilometre Study Area. These EPS licences relate to the same development (one being a licence amendment). The EPS licence was for damage of a resting place, located 3.3 kilometres south-east of the Site Boundary. No EPS licences have been granted for Leisler's bat within the 3-kilometre Study Area, or serotine within the 4-kilometre Study Area.

11.6.285 No noctule or serotine roosts have been identified by third parties as part of planning applications within the 4-kilometre Study Area, or Leisler's bat within the 3-kilometre Study Area.

Roost Identification

11.6.286 The locations of the roost records are presented on **Figure 11.24, Appendix 11.10** (Document Reference: 3.11.10). For consistency in roosting reference,

the roosts have been renamed for the Chapter. **Table 11-28** provide details of the ES roost reference, and the reference of the roost in the Appendices, along with what Appendix that the roost was identified.

11.6.287 No Leisler's bat or serotine were caught during radio-tracking surveys, or recorded roosting in trees and structures surveyed for the Proposed Scheme.

11.6.288 Serotine roost mainly within buildings with high gables and cavity walls and are rarely found to roost in trees (BCT, 2010d). No buildings are present within the Site Boundary, though residential and farm buildings present adjacent to the Site Boundary.

11.6.289 Leisler's bat use trees for roosting in both summer and winter, with both maternity hibernation roosts identified within trees. Leisler's bat predominately roost in forests / woodlands, which are found within the Site Boundary (BCT, 2010e).

11.6.290 As no Leisler's bat or serotine roosts were recorded during the surveys, these species are not included further within the roost identification.

Tree Surveys

11.6.291 No noctule roosts were recorded during summer surveys in trees.

11.6.292 Hibernation climbing surveys identified one noctule hibernation roost in ES45. A single bat was present in the roost.

Structure Surveys

11.6.293 No noctule roosts were recorded during surveys of structures.

Radio-tracking Surveys

11.6.294 A total of seven noctules were caught during the 2019 radio-tracking surveys for the Proposed Scheme, with one adult male fitted with a radio-transmitter. A total of 22 noctules were caught during 2021 radio-tracking surveys for the Proposed Scheme, with none subject to radio-tracking.

11.6.295 One noctule roost (ES97) was identified through radio-tracking surveys for the Proposed Scheme, which was a day roost (assumed) in a bungalow located 1.9 kilometres south-east of the Site Boundary within Ave's Gap wood.

Full Summary

11.6.296 A total of two noctule roosts; one day roost and one hibernation roost, have been identified during surveys for the Proposed Scheme, which are detailed within **Table 11-28**, and shown on **Figure 11.24, Appendix 11.10** (Document Reference: 3.11.10).

Table 11-28 Noctule Roost Summary

Roost Ref (ES)	Appendix	Appendix Roost Ref	Status	Peak Count	Grid Reference	Tree or Structure	Distance
ES97	11.1	12	Day	Inconclusive (no access)	TG 13489 12580	Tree	1.98km
ES45	11.3	78	Hibernation	1	TG 13373 15346	Tree	90m

Commuting and Foraging

Incidental Vantage Point Surveys

11.6.297 During VP surveys, noctules were incidentally recorded commuting and foraging. Records of noctules were recorded at all VP locations, with behaviour activity noted at the following locations:

- Commuting along the woodland ride within Nursery Woodland (VP1);
- Commuting south-west across grassland between Long Plantation and Spring Hills (VP3);
- Foraging to the north of the Broadway (VP6);
- Commuting at Foxburrow Stream (VP8);
- Commuting across Fakenham Road at a hedgerow north of Fakenham Road (VP10), and across Fakenham Road at a woodland copse north of Fakenham Road (VP11); and
- Foraging along a hedgerow north of Fakenham Road (VP12).

11.6.298 For Leisler's Bat, a single pass was recorded at grassland between Long Plantation and Spring Hills (VP3). The bat was heard not seen, so no behaviour was observed.

11.6.299 During VP surveys, serotine were incidentally recorded commuting and foraging. Passes of serotine were recorded at all VP locations with the exception of VP7 in Foxburrow Plantation. Behaviour activity was noted at the following locations:

- Foraging between grassland between the Nursery Woodland / Rose Carr and Spring Hills (VP2) during a survey in September 2020;
- A single record of a serotine commuting east along a hedgerow at Ringland Lane (VP4);
- A single record of a serotine commuting east to west along the Broadway (VP6); and

- A single record of a serotine commuting across Fakenham Road at both a woodland copse (VP11), and hedgerow (VP12) located north of Fakenham Road.

Automated Static Detectors

11.6.300 A summary of the of the levels of noctule, Leisler's bat or serotine within each broad habitat type recorded via automated detector surveys during summer 2019, 2020 and 2021, and winter 2020 / 2021 is detailed in **Table 11-29**.

11.6.301 Automated detector locations shown on **Figure 11.4, Appendix 11.10** (Document Reference: 3.11.10) (summer deployments) and **Figure 11.5, Appendix 11.10** (Document Reference: 3.11.10) (winter deployments), and locations of woodland names and features referred too are shown on **Figure 11.2, Appendix 11.10** (Document Reference: 3.11.10).

Table 11-29 Automated Detector surveys – Summary of Results – Noctule, Leisler's Bat, Serotine and Nyctalus Species

Broad Habitat Type	Summer / Winter	No. of Detectors (No of nights total)	N.noc Bat Activity Index Value (BAIV)	N.noc Peak Detector Activity (ppn) / ASD reference	N.noc Peak activity location	N.Lei Bat Activity Index Value (BAIV)	N.Lei Peak Detector/ Location (Note 1)	N.Lei Peak Detector Activity (ppn) / ASD reference	E.ser Bat Activity Index Value (BAIV)	E.ser Peak Detector Activity (ppn) / ASD reference	E.ser Peak Activity Location
Grassland	Summer	8 (155)	6.83	9.93ppn (M52)	Grassland between Spring Hills and Nursery Woodland (within Red Line Boundary in Compensation Extent)	0.03	0.20ppn (M50)	Grassland north of Primrose Grove (within Site Boundary)	0.67	1.40ppn (M51)	Grassland between Rose Carr and Spring Hill (outside the Site Boundary)
Hedgerow	Summer	30 (701)	5.68	30.55ppn (C85)	Hedgerow north of Fakenham Road (outside the Site Boundary)	0.05	0.36ppn (C25)	Hedgerow north of A47 (within the Site Boundary)	0.87	3.96ppn (C56)	Hedgerow north of Weston Road (within the Site Boundary)
Hedgerow	Winter	5 (175)	0.07	0.23ppn (C69)	Hedgerow along Ringland Lane (within the Site Boundary)	0.00	0.00	Not applicable	0.00	0.00	Not applicable
River	Summer	1 (25)	15.00	15.00ppn (C1)	River Wensum (within the Site Boundary)	0.20	0.20ppn (C1)	River Wensum (within the Site Boundary)	0.48	0.48ppn (C1)	River Wensum (within the Site Boundary)
River	Winter	1 (35)	0.11	0.11ppn (C1)	River Wensum (within the Site Boundary)	0.00	0.00	Not applicable	0.00	0.00	Not applicable

Broad Habitat Type	Summer / Winter	No. of Detectors (No of nights total)	N.noc Bat Activity Index Value (BAIV)	N.noc Peak Detector Activity (ppn) / ASD reference	N.noc Peak activity location	N.Lei Bat Activity Index Value (BAIV)	N.Lei Peak Detector/ Location (Note 1)	N.Lei Peak Detector Activity (ppn) / ASD reference	E.ser Bat Activity Index Value (BAIV)	E.ser Peak Detector Activity (ppn) / ASD reference	E.ser Peak Activity Location
Woodland	Summer	47 (1063)	5.24	22.12ppn (C24)	Foxburrow Plantation (within the Site Boundary)	0.55	4.72ppn (C23)	Foxburrow Plantation (within the Site Boundary)	3.01	27.08ppn (R4)	Juniper Valley (outside the Site Boundary)
Woodland	Winter	8 (280)	0.04	0.14ppn (C71)	Gravelpit Plantation (outside of the Site Boundary)	0.00	0.00	Not applicable	0.01	0.05ppn (C64)	Telegraph Hill (outside the Site Boundary)
Woodland edge	Winter	6 (210)	0.21	1.0ppn (C49)	Northern edge of Rose Carr (within the Red Line Boundary, in Compensation Extent)	0.00	0.00	Not applicable	0.01	0.03ppn (C21, C62, C70)	The Broadway and Long Plantation (within the Site Boundary)

Note 1: N.noc = noctule, N.Lei = Leisler's bat and E.ser = serotine

Noctule

11.6.302 The highest level of noctule activity across all detectors during the summer surveys was recorded along hedgerows. Activity levels, in order of activity, in the Site Boundary are detailed below:

- C85 recorded an average of 30.55ppn, located along a hedgerow partially within the Site Boundary, north of Fakenham Road, at the location of VP10;
- C82 recorded an average of 24.75ppn, recorded at a hedgerow to the north of Fakenham Road within the Site Boundary, at the location of VP12;
- C24 recorded an average of 22.12ppn, located in woodland habitat at Foxburrow Plantation within the Site Boundary, near too VP8;
- C14i recorded an average of 21.96ppn, located in woodland habitat at Foxburrow Plantation adjacent to the Site Boundary to the west;
- C1 recorded an average of 15.00ppn, locate at the River Wensum within the Site Boundary; and
- M52 recorded an average of 9.93ppn, located within grassland habitats between Spring Hills and Nursery Woodland, within the Red Line Boundary in the Compensation Extent.

11.6.303 During winter surveys, low levels of noctule activity were recorded in all habitats type with all locations recording an average of less than 1ppn.

Leisler's Bat

11.6.304 The highest level of Leisler's bat activity across all detectors during the summer surveys was recorded within woodland habitats. Activity levels, in order of activity, in the Site Boundary are detailed below:

- C23 recorded an average of 4.72ppn, located in woodland habitats at Foxburrow Plantation within the Site Boundary;

- B11i recorded an average of 3.72ppn, located on the southern edge of Foxburrow Plantation at the location of VP8, within the Site Boundary;
- C21 recorded an average of 3.60ppn, located along the Broadway at VP6, within the Site Boundary; and
- C7 recorded an average of 3.00ppn, located on the eastern edge of Long Plantation at VP3 within the Site Boundary.

11.6.305 The remaining habitats surveyed in summer was:

- Grassland – only one detector of the eight detectors recorded activity, with a peak of 0.20ppn recorded at M50 at the grassland north of Primrose Grove within the Site Boundary;
- Hedgerows – a peak of 0.36ppn recorded at C56 at a hedgerow north of Fakenham Road within the Site Boundary. The remaining detectors recorded between 0 and 0.28ppn, with 49% of the detectors recording no activity; and
- River Wensum - recorded an average of 0.48ppn.

11.6.306 No Leisler's bat activity was recorded during winter surveys across all habitat types and locations.

Serotine

11.6.307 The highest level of serotine activity across all detectors during the summer surveys was recorded within woodland habitats. Activity levels, in order of activity, in the Site Boundary are detailed below:

- C42 recorded an average of 9.12ppn, and C41 recorded an average of 8.18ppn both within woodland habitats at Foxburrow Plantation within the Site Boundary; and
- C20 recorded an average of 6.05ppn, and C21 recorded an average of 4.56ppn. Both are located along the Broadway at VP6, within the Site Boundary; and

- C56 recorded an average of 3.96ppn, which was installed along a hedgerow north of Weston Road within the Site Boundary, where VP5 was undertaken.

11.6.308 R4, which was installed within woodland as part of the control group recorded an average of 27.08ppn. This detector was located 450 metres north-west of the Site Boundary within Juniper valley. R5, which was installed within woodland in Spring Hill as part of the control group recorded an average of 10.60ppn. This detector was located approximately 400 metres north-east of the Site Boundary.

11.6.309 The remaining habitats surveyed in summer were grassland habitats which all recorded an average of less than 1.40ppn, and the River Wensum which recorded an average of 0.48ppn.

11.6.310 During winter surveys, serotine activity recorded in woodland and woodland edge habitats was an average of 0.1ppn, with no activity recorded along hedgerows or the River Wensum.

Overall Species Summary and Geographical Value

Noctule

11.6.311 One hibernation roost was identified at Rose Carr in the Northern Woodlands, which is located outside of the Site Boundary.

11.6.312 Noctule activity was highest at the hedgerows north of Fakenham Road. C82 (along VP12) recorded monthly peaks of 66.20ppn in June and 58.60ppn in July, and C85 (along VP10) recorded peaks of 40.80ppn in June and 48.00ppn in July.

11.6.313 Records of noctule commuting across Fakenham Road were recorded incidentally at VP10 and VP11, and incidental records of foraging were recorded at a hedgerow north of Fakenham Road (VP12).

11.6.314 Foxburrow Plantation recorded noctule activity, with peak of an average of 22.12ppn recorded at C24 within the Site Boundary. This detector recorded a peak of activity with 91.60ppn recorded in August, and the remaining months

of the summer surveys average between 0.20ppn and 10.00ppn. Incidental records of noctule commuting at Foxburrow Stream were recorded during VP8.

Noctule Geographical Value

11.6.315 Noctule fall under legislative and policy protection, including being an EPS of the Habitats Regulations; and receiving protection under the WCA. Noctule is identified as a SPI (Section 41 of the NERC Act, 2006), and are included as a priority species on the NBAP (NBAP, 2009b). Noctule is widespread within England, and the population of noctule in England is considered to have been stable over the period 1999-2019 (BCT, 2023).

11.6.316 Noctule is considered to be widespread in many geographies, but not as abundant in all (Reason, P.F. and Wray, S., 2023). Given this, the roosts within and adjacent to the Proposed Scheme fall under the following geographic value:

- Hibernation (small numbers): *Site*
- Day roost: *Site*

11.6.317 Given the survey findings, stable population, and widespread distribution, noctule is assessed as being an Important Ecological Feature of Site value.

Leisler's Bat

11.6.318 Foxburrow Plantation recorded the highest level of Leisler's bat activity, with peaks of activity being 11.80ppn in July, and 11.60ppn in August at C23. The remaining months at this location during summer recorded between 0 and 0.20ppn. B11i recorded similar activity levels, with 16ppn recorded in August, and the remaining months recording between 0.20 and 2.20ppn.

11.6.319 The Broadway also recorded a peak of Leisler's bat activity with 17.80ppn recorded in August. This was at detector C21 installed along VP6. The remaining months in summer recorded between 0 and 0.20ppn.

11.6.320 Long Plantation recorded a peak of 13.60ppn recorded in July at C7, with no activity recorded the remainder of the months. This detector was installed at VP3. A single pass of Leisler's bat was also recorded incidentally during VP3.

Leisler's bat Geographical Value

11.6.321 Leisler's bat fall under legislative and policy protection, including being an EPS under the Habitats Regulations; and receiving protection under the WCA. These bats are listed on the NBAP as being present within Norfolk; however, no details are provided on the abundance of records (NBAP, 2009b).

11.6.322 Leisler's bats have a scattered distribution across England, with a greater distribution within the south of England, including East Anglia (Mathews *et al,* 2018). There is insufficient data for Leisler's bats to detect any changes in population trends (BCT, 2023).

11.6.323 No Leisler's bat roosts were recorded as part of the Proposed Scheme survey effort and Leisler's bat is considered to be rarer / have a restricted distribution in East Anglia (Reason, P.F. and Wray, S., 2023).

11.6.324 Given the lack of recorded roosts and lower levels of activity recorded, Leisler's bat is assessed as being an Important Ecological Feature of Site value.

Serotine

11.6.325 Foxburrow Plantation recorded the highest serotine activity within the Site Boundary, with peaks of activity of 29.20ppn at C32 in August 27.60ppn recorded at C42 in September and 24.80ppn recorded at C41 in September. These three locations, all within Foxburrow Plantation within the Site Boundary, recorded between 0 and 4ppn the remanding summer months.

11.6.326 The Broadway also recorded a peak of serotine activity with 20.41ppn recorded in August at C21, and 20.00ppn recorded at C20 in August. Both detectors installed along the Broadway VP6. The remaining months in summer recorded between 0 and 10.00ppn. A suspected serotine was also recorded incidentally commuting along the Broadway during VP6.

11.6.327 However, the highest levels of serotine activity was recorded at two control locations outside of the Site Boundary, at R4 located within Juniper Valley 445 metres north-west of the Site Boundary, and R5 located within Spring Hills 375 metres north-west of the Site Boundary. Peaks of activity recorded was 128.80ppn recorded in September at R4, and 50.20ppn recorded in August at R5.

Serotine Geographical Value

11.6.328 Serotine fall under legislative and policy protection, including being an EPS under the Habitats Regulations and receiving protection under the WCA. These bats are listed on the NBAP as being present within Norfolk. However, no details are provided on the abundance of records (NBAP, 2009b).

11.6.329 Serotine is only located within southern England, including East Anglia, and the population of serotine in England is considered to have been stable since 1999 (BCT, 2023).

11.6.330 No serotine roosts were recorded as part of the Proposed Scheme survey effort, reflecting their restricted distribution within East Anglia (Reason, P.F. and Wray, S., 2023).

11.6.331 Given the lack of recorded roosts and lower levels of activity recorded, Serotine is assessed as being an Important Ecological Feature of Site value.

11.7 Future Baseline

Overview

11.7.1 The EIA Regulations require consideration of the likely evolution of the baseline conditions over time, without the implementation of the Proposed Scheme. This means assessing likely natural change using available / foreseeable environmental information and scientific knowledge.

11.7.2 Climate change is the dominant factor when attempting to predict the future baseline of an ecosystem or species community. Climate change affects ecology via multiple pathways. Impacts on species are considered to include changes in distribution and abundance, the timing of seasonal events and

habitat use and, as a consequence, there are likely to be changes in the composition of plant and animal communities. Habitats and ecosystems are also likely to change in character.

11.7.3 Assessing the potential impacts of climate change on ecological features is problematic as species trends in distribution and population size are influenced by multiple factors. These include environmental considerations (such as atmospheric pollution and land use) and population biology (such as density dependence). These different factors can work in combination to bring about change. Moorcroft & Speakman (2015) present a study which summarises key research on the impacts of climate change on habitats and species in the UK. They conclude that there is strong evidence that climate change is affecting UK biodiversity. Importantly, impacts are expected to increase as the magnitude of climate change increases.

11.7.4 The distributions of many species are shifting northwards, including some species which have colonised the UK from mainland Europe while some species are seen to be utilising habitats at a higher altitude than known previously.

11.7.5 It is possible that climate change will increase the range (and abundance) of some species. However, it is also possible that climate disruption will lead to an increase in cold wet springs, which may in fact cause populations on the edge of their range to be more vulnerable. Very hot (or very wet) summers can also result in juvenile deaths (i.e. low breeding success). If so, any additive mortality from other factors would represent a greater risk (Sherwin *et al*, 2013).

11.7.6 With regards to the IEFs known to be present in the Site Boundary, it is difficult to predict with considerable confidence their likely response to climatic change. However, the following sections present known information on the medium and long-term trends in distribution and abundance for such features.

Barbastelle

11.7.7 Barbastelle is listed on Annex II of the Habitats Regulations and categorised as 'Near Threatened' on the International Union for the Conservation of Nature Red

List of Threatened Species (Piraccini, R (2016). In the Mammal Society's Red List of UK Mammals, barbastelles are listed as 'vulnerable' (Mathews, F and Harrower, C, 2020). This species is regarded as rare in the UK (BCT, 2010), and is identified as a SPI (Section 41 of the NERC Act, 2006).

11.7.8 The known distribution of barbastelles is within the south of England, including East Anglia (Mathews *et al,* 2018). Within Norfolk, barbastelle is listed on NBAP as a priority species and are listed as having a 'Likely Significant Population' (NBAP, 2009a). Norfolk is considered a stronghold for barbastelles, with a review published by the NBSG detailing that there are currently 24 barbastelle maternity colonies in Norfolk, identified through NBSG surveys. The article quotes that '*this nationally rare species* [barbastelle] *is now regarded as something of a Norfolk speciality*" and that where there are gaps in distribution within Norfolk, that it is "*probably a reflection of the lack of studies in those areas, but we expect colonies* [of barbastelle] *to be present wherever there are suitable roost woodlands*" (Harris, J. 2020).

11.7.9 Supporting documentation for the conservation status assessment for barbastelle published in 2019 was reviewed, which details that more than 30 maternity roosting locations for barbastelle have now been found, which are in tree holes bar one, a building in Paston Great Barn NNR, Norfolk (JNCC, 2019). The Suffolk Bat Group has produced a distribution atlas for bats in Suffolk, showing the spread of different bat species throughout the county. A figure (p3) shows a significant increase in barbastelle records along the Suffolk / Norfolk border.

11.7.10 There is currently insufficient data for barbastelle to detect any changes in population trends (JNCC, 2019) (BCT, 2023); apparent recent increases are likely to be the result of increased detectability and focussed survey effort.

Brown long-eared bat

11.7.11 Brown long-eared bats are considered to be widespread in all geographies (Reason, P.F. and Wray, S., 2023). Brown long-eared bats are identified as a SPI (Section 41 of the NERC Act, 2006). Within Norfolk, brown long-eared

bats are included as a priority species on the NBAP and are listed as being the 'second most common bat in Norfolk' (NBAP, 2009b).

11.7.12 The population of brown long-eared bat in England is considered to have been stable since 1999 (BCT, 2023).

Myotis species

11.7.13 Natterer's bats and Daubenton's bats are considered to be widespread in many geographies, but not as abundant in all (Reason, P.F. and Wray, S., 2023). Natterer's bats are present throughout England, and it is considered that the population of Natterer's bat in England has increased since 1999 (BCT, 2023). Daubenton's bats are present throughout England, and population of Daubenton's bat in England is considered to have been stable since 1999 (BCT, 2023).

11.7.14 Daubenton's bat is listed as the third most common species recorded in Norfolk, as per the NBAP (NBAP, 2009b). No details on the abundance of Natterer's bat is included within the NBAP.

Soprano pipistrelle

11.7.15 Soprano pipistrelles are considered to be widespread in all geographies (Reason, P.F. and Wray, S., 2023). Soprano pipistrelles are identified as a SPI (Section 41 of the NERC Act, 2006). Within Norfolk, soprano pipistrelle is included as a priority species on the NBAP and are listed as being 'under recorded' (NBAP, 2009b).

11.7.16 The population of soprano pipistrelle in England is considered to have been stable since 1999 (BCT, 2023).

11.8 Sensitive Receptors

11.8.1 **Table 11-30** lists the sensitive bat species receptors, referred to as IEF, that have been scoped in for further assessment:

Table 11-30 Important Ecological Features (IEF) scoped in for further assessment

Receptor	Value
Barbastelle	National
Myotis species	County
Brown long-eared bat	District
Soprano pipistrelle	District

11.9 Preliminary Assessment of Likely Impacts and Effects

11.9.1 This section details the assessment of significant effects having taken into account Embedded Mitigation, as described in **Chapter 3: Description of the Proposed Scheme** (Document Reference: 3.03.00) and summarised below, but in the absence of Additional Mitigation. Additional Mitigation for the Proposed Scheme is described in **Section 10** of this chapter.

Embedded Mitigation

11.9.2 The design of the Proposed Scheme, where possible, has included Embedded Mitigation to avoid potential adverse effects to bats. The alignment of the Proposed Scheme is designed to avoid important ecological features where possible, notably the ancient woodland; and to avoid / minimise loss of identified roosts, foraging, and commuting habitats. In addition, the Embedded Mitigation includes:

- Designing the River Wensum Viaduct to maximise landscape permeability, allowing continued bat movement beneath the Proposed Scheme along the river corridor. The design comprises a ten-span single-deck bridge with a reinforced concrete deck slab, minimising the number of piers within the floodplain. Additionally, a 1.2 metre environmental barrier, designed for acoustic performance, would run along the entire length of both carriageways minimises disturbance from noise on adjacent habitats.

- Providing green bridges and underpasses as multi-functional connections east to west, across the Proposed Scheme. Each has been designed for its setting to maintain, as far as is practicable, existing flight paths (linear vegetation and dark corridors) to facilitate continued use.
- Including an additional underpass, located at Ringland Lane (chainage 1700 – 1800). This feature takes advantage of the need for continued road access (the primary purpose of the underpass). Designed to accommodate bat movement, it provides additional landscape connectivity.
- Landscape planting to provide foraging and commuting habitats as part of the Proposed Scheme design.
- Including additional landscape treatments where the road is in cutting. These are where the Proposed Scheme passes through woodland blocks where the alignment cannot accommodate green bridge / underpass designs, and where no specific bat flight lines were identified. Their purpose is to encourage safe movement (above the traffic corridor) should bats continue to cross between woodland parcels. Dense scrub and / or fencing is incorporated into the design to encourage safe flight above traffic height.
- Drainage systems designed to intercept and divert run-off away from watercourses and floodplains, most notably the River Wensum which is a foraging area for a number of species recorded within the Site Boundary.
- Adopting a 'low noise' road surface, to be used throughout the Proposed Scheme to reduce operational noise levels (see **Chapter 7: Noise and Vibratio**n (Document Reference: 3.07.00)).

11.9.3 In addition, a number of Best Practicable Means (BPM) to manage noise and vibration are detailed within **Chapter 7** (Document Reference: 3.07.00), such as

the provision of earth bunds within the design, to provide screening. Temporary environmental noise barriers may also be considered to minimise the impacts at sensitive receptors where such barriers are likely to be effective.

11.9.4 The OBMS provided in **Appendix 11.6** (Document Reference: 3.11.06) has been produced for the Proposed Scheme and details the Embedded Mitigation measures in Section 2. The OBMS will inform an application for a bat EPSML required for the Proposed Scheme..

Green Bridge Design Overview

11.9.5 The green bridge designs are described within **Appendix 11.6: OBMS** (Document Reference: 3.11.06). Each bridge design was adapted to the specifics of its location. An overview of the general design is as follows:

- Green bridges have been designed to fit within the specific location, with an aim to reduce woodland / tree loss where possible and align as far as possible to existing commuting routes.
- Existing vegetation, notably established trees, and shrubs, would be retained (as far as possible) at either end of each structure, and planting incorporated to create a continuous band of shrub and tree planting between retained woodland / hedgerow areas either side of the Proposed Scheme.
- Green bridges would be planted with at least two rows of 'instant' native hedgerow (with a minimum installation height of 1.8 to 2 metres) to provide immediate vegetation connectivity. Further detailed within **Appendix 11.6: OBMS** (Document Reference: 3.11.06).
    - As a minimum, this would include double hedgerows, with designs specific to each bridge, which would be 600mm in width; and
    - Native whips would be planted and interspersed alongside the hedgerows to provide further structure and species diversity and

ensure the longevity of the planting. The location of the native whips varies between bridges..

- Designs would allow sufficient substrate depth of 750mm, to allow vegetation to meet target dimensions (two central ‘instant’ hedgerows to mature to at least 4 metres in height), and appropriate drainage to minimise the need for artificial irrigation in the medium to longer term.
- New planting would be installed at the earliest reasonably practicable opportunity to allow vegetation to become established prior to the opening of the road.
- Planting stock would comprise native species of local provenance selected to provide sufficient height and density to function as bat foraging and commuting habitat from installation onwards.
- In specific locations, to aid connectivity to the green bridges, the planting stock detailed above would include the use of 'instant’ hedgerows leading to the green bridges.
- Where required, specifically where there is a large amount of retained vegetation, fencing is incorporated into the design to aid safe movements (i.e. above traffic height).
- The bridges would not be lit, and the designs would include a closed parapet to avoid light spill from vehicles on the road below spilling onto the bridge.
- Disturbance would be minimised during installation of green bridges, for example by:
    - where feasible avoiding night-time working to prevent nocturnal noise and light pollution along the bat flight path;
    - minimising vegetation clearance and the time prior to replanting; and

- installing suitable Temporary Flightlines (TFLs) during the construction phase to maintain habitat connectivity in advance of replanting. Details of TFLs are detailed within **Section 10**: Additional Mitigation and Enhancement Measures.

Underpass Design Overview

11.9.6 The underpass designs are described within **Appendix 11.6: OBMS** (Document Reference: 3.11.06). Each underpass design was adapted to the specifics of its location. An overview of the general design is as follows:

- Underpasses would be a minimum of 4 metres height x 4 metres width (once topsoil and surfacing have been accounted for).
- The 'wing walls' would be splayed to aim to funnel bat movement, at each end of the underpass, towards the tunnel entrance.
- Underpasses would not be artificially lit and vegetation planting along the edges of the road above, as well as closed parapets (of at least 1.4 metres high) along the edges of the underpass, would deflect light spill from the road, and ensure that a dark corridor is maintained.
- Landscape planting would be used to augment existing vegetation connected to the underpass locations, to strengthen and enhance bat commuting routes.
    - new planting would be installed at the earliest opportunity, to reduce the time between vegetation establishing to full functionality and the road opening;
    - planting stock would comprise native species of local provenance selected to provide sufficient height, and density to function as bat foraging and commuting habitat from installation onwards; and
    - in specific locations, to aid connectivity to the underpasses, the planting stock detailed above would include the use of 'instant' hedgerows leading to the underpasses.

- Disturbance would be minimised during installation of underpasses, for example by:
    - where feasible, avoiding night-time working to prevent nocturnal noise and light pollution along the known bat flight paths;
    - minimising vegetation clearance and the time prior to replanting; and
    - installing suitable artificial TFLs during the construction phase to maintain habitat connectivity in advance of replanting.

11.9.7 Three temporary storage areas are located within agricultural fields within the north-east of the Red Line Boundary. Embedded Mitigation measures comprising relevant and specific commitments with respect to the use of this area would be mandated by their inclusion in the Proposed Scheme OCEMP **'Environmental Statement – Chapter 3 Appendix 1: Outline Construction Environmental Management Plan (OCEMP)**' (Document Reference: 3.03.01). Practical measures would include:

- The use of a 50-metre buffer to protect known roosts and roosting resource.
- The height of stockpiles to be reduced as much as possible within the available area (outside of the buffers).
- Buffering of potential flightlines with the use of protective fencing and stockpiles adjacent to hedgerows.
- A 50 metre buffer zone between these storage areas and retained woodland within Primrose Grove.
- The use and inclusion of targeted and controlled lighting.

Construction Phase

11.9.8 The likely significant effects for bats associated with the construction phase are set out below, followed with a more detailed species-specific assessment.

Roost Losses and Disturbance

11.9.9 Baseline assessment identified 15 roosts within 13 trees that would be permanently lost through construction of the Proposed Scheme. In addition, two roosts within ES52 would be temporarily closed to facilitate the construction of the Proposed Scheme. Additionally, a single tree containing a single roost would be damaged as a result of construction activities for the Proposed Scheme, and three roosts across two trees and areas of roost resource will be disturbed from the construction and / or operation of the Proposed Scheme. Details of the roost types being impacted, along with the Roost Reference, are provided in **Table 11-31**.

Table 11-31 Summary of Roost Impacts

Species	Roost Type	Roost Reference	Impact
Barbastelle	1 x Day Roost	ES37	Disturbance
Daubenton's bat	1 x Hibernation	ES65	Loss
Natterer's bat	1 x Hibernation	ES65	Loss
Daubenton's bat	1 x Hibernation	ES52	Temporary closure
Brown long-eared bat	2 x Day Roosts	ES42, ES70	Loss
Brown long-eared bat	1 x Maternity	ES43	Loss
Brown long-eared bat	1 x Day Roost	ES44	Damaged
Brown long-eared bat	1 x Hibernation	ES52	Temporary closure
Soprano pipistrelle	6 x Day	ES71, ES73, ES74, ES75, ES76, and ES77	Loss

Species	Roost Type	Roost Reference	Impact
Soprano pipistrelle	1 x Hibernation	ES75	Loss
Soprano pipistrelle	1 x Maternity	ES79	Loss
Soprano pipistrelle	1 x Hibernation	ES78	Disturbance
Common pipistrelle	2 x day roost	ES90, ES91	Loss
Common pipistrelle	1 x Hibernation	ES78	Disturbance

11.9.10 It has been noted that numerous trees are used by an individual bat during the active season. This behaviour is typical of the roost-switching behaviour regularly exhibited by woodland roosting bats, and the exhibition of fission-fusion behaviour (temporary splitting into subgroups) in many woodland species, including barbastelle (Hillen *et al*, 2010; Russo *et al,* 2005). Therefore, roost loss has been calculated on the loss of the roost resource and not simply based on the loss of identified roosts.

11.9.11 In addition to the confirmed roosts, 16 high roost suitability trees and 30 moderate roost suitability trees would require felling to facilitate construction of the Proposed Scheme. These 46 trees have been subject to full survey effort and are included within this assessment to account for the loss of roost resource availability. An additional two trees have been included as 'day roosts lost' on a precautionary approach. The survey effort for these was reduced when compared to best practice guidelines (Collins, 2016), due to surveyors having to cancel the final survey for both trees due to Health & Safety reasons.

11.9.12 It should be noted that the roost and roost-resource loss calculations, and assessments of damage and disturbance provided here are based on a worst-case site-clearance scenario of the Proposed Scheme. It is possible that less land would be required as the construction programme and methodologies are confirmed.

11.9.13 The Proposed Scheme would result in the loss of breeding sites and resting places for bat species within (or in some cases in proximity to) areas of construction. In the absence of mitigation, bats within and in proximity to the Site Boundary would also be at risk of injury or being killed during site and vegetation clearance operations.

11.9.14 Removal and disturbance of habitats would reduce the availability of suitable roosting habitat and resource within the local landscape. The habitats that would be removed are widely represented in the wider local landscape.

Foraging Habitat Losses and Degradation

11.9.15 The foraging habitat within and adjacent to the Site Boundary comprises woodland, scrub, grassland, hedgerow, and riparian habitats. Surveys undertaken demonstrated that the habitats within the Site Boundary are being used by a number of bat species for commuting and foraging (**Appendix 11.4,** Document Reference: 3.11.04) (**Appendix 11.5,** Document Reference: 3.11.05). This bat data confirms that the woodland, hedgerow, and riparian habitat is of greatest value to the local bat assemblage.

11.9.16 Site and vegetation clearance associated with the construction of the Proposed Scheme would result in the removal of a proportion of the foraging habitats suitable to support extant bat populations within the Red Line Boundary. It is expected that these habitats would be lost or subject to a substantial level of disturbance during the construction of the Proposed Scheme, which would include construction of new infrastructure, movement of plant and vegetation clearance.

11.9.17 Construction of the Proposed Scheme and associated site and vegetation clearance work is expected to lead to both temporary and permanent removal of a proportion of habitats, as discussed above.

11.9.18 It is assumed that habitats that are to be lost temporarily would be reinstated to their former habitat and condition. All woodland habitat loss occurs within the Site Boundary, these losses are listed in **Table 11-32**.

Table 11-32 Woodland Habitats to be retained, temporarily lost, or permanently lost

Woodland Habitats	**Area (ha) within the Site Boundary**	**% of total the Site Boundary**	**Permanent habitat loss (ha)**	**Retained habitat (ha)**
Lowland mixed deciduous woodland	23.74	8.27%	4.03	19.71
Other woodland; broadleaved	0.81	0.28%	0.30	0.51
Other woodland; mixed; mainly broadleaved	15.85	5.52%	5.77	10.06
Wet Woodland	2.71	0.94%	0	2.71
Total	***43.11***	***15.01%***	**10.01**	**30.28**

11.9.19 All hedgerow losses occur within the Site Boundary, these losses are listed in **Table 11-33**.

Table 11-33 Hedgerows to be retained, temporarily lost, or permanently lost

Linear Habitats	Length (km)	Temporary loss	Permanent loss (km) / % of total hedgerows	Retained (km) / % of total hedgerows
Hedgerow	8.59	0	5.78 / 67.29%	2.81 / 32.71%
Line of trees	1.29	0	0	1.29 / 100%

11.9.20 The installation of single-track maintenance access routes beneath the new River Wensum Viaduct would result in habitat loss, although there would be minimal reduction in riparian habitat available to foraging bats.

11.9.21 The above would result in a reduction of available foraging habitats for bat populations, all of which lies within the habitats used by the extant bat population. In comparison to the woodland losses detailed within **Table 11-32**, an assessment of the freely available NE datasets available via MAGIC were used to search for woodland HPI. In total 1670ha of deciduous woodland is present within 6 kilometres of the Site Boundary, the largest CSZ of the bats recorded within the Site Boundary.

11.9.22 Increased levels of noise and vibration relative to the baseline situation are anticipated during construction. Piling would occur at a number of locations within the Site Boundary where structures are being built. This includes the River Wensum Viaduct, ancient woodland retaining wall at Primrose Grove and the four green bridges. Given the scale of the construction works associated with the Proposed Scheme, and the low existing noise levels in the area, increased construction noise and vibration effects are likely, specifically within these structures' locations. However, these effects would be limited in space and time, and being aware of a noise is not the same as being disturbed by it; minor 'disturbance' is unlikely to cause a change in behaviour. Tolerance to noise would differ between species and behaviours, seasonality

and roosting status, and the character of noise would also influence responses.

11.9.23 Severe noise disturbance could increase the length of commuting routes, increasing flight time and stress, which in turn have the potential to reduce survival and reproductive success, specifically in relation to during periods of high energetic demand such as lactation (Papouchis *et al.* 2001; Stone *et al.* 2009). However, unweighted frequency-specific measurements undertaken for another scheme (Reason, P.F. and Wray, S., 2023) indicate that disturbance to roosts beyond 50 metres is unlikely (even on a precautionary basis), as are impacts on flight behaviours. Within 50 metres, a site- and activity-specific impact assessment should be conducted once the detail of equipment, duration, location, season etc are confirmed to ensure restrictions are appropriate, effective, and pragmatic. This is only likely to be required for piling and similarly 'noisy' activities.

11.9.24 Embedded Mitigation measures with respect to noise and vibration are included in the Proposed Scheme OCEMP **'Environmental Statement – Chapter 3 Appendix 1: Outline Construction Environmental Management Plan (OCEMP)'** (Document Reference: 3.03.01). A number of BPM are included within the mitigation design within **Chapter 7: Noise and Vibration** (Document Reference: 3.07.00). These include the provision of earth bunds within the design, and the use of temporary environmental noise barriers to be considered by the contractor to minimise the impacts at sensitive receptors. These measures are described in within **Chapter 7: Noise and Vibration** (Document Reference: 3.07.00) and would reduce the risk of noise and vibration during the construction phase. Species-specific assessments are presented in subsequent sections of this report.

11.9.25 Lighting is known to pose a barrier to bat movement, resulting in severance of a commuting route to areas of foraging habitat, or deterring roost access (Stone *et al.* 2015). Different species of bat have been shown to have different reactions to the presence of artificial light, with woodland species such as barbastelle, long-eared bats and *Myotis* species being less tolerant of light, which may impact upon fitness and breeding success (ILP, 2018; ILP, 2023).

11.9.26 The effects of increased noise, vibration and lighting during construction would likely result in the degradation of retained habitat for bats. The extent of degradation would be influenced by a number of factors including the detailed Proposed Scheme design, construction methodology and Embedded Mitigation performance..

Severance and Fragmentation

11.9.27 The Proposed Scheme cuts through tracts of woodland, which are known to collectively support roosting bats. Additionally, temporary disruption through noise and light disturbance during construction could result in temporary severance / fragmentation even in the absence of habitat loss.

11.9.28 A minimum of five confirmed commuting routes would be severed by the Proposed Scheme. As detailed above, in combination, physical severance, increased noise and lighting could increase the length of commuting routes, increasing flight time and stress, which in turn have the potential to reduce survival and reproductive success (Papouchis *et al.* 2001; Stone *et al.* 2009). Road infrastructure is known to influence the distribution of bat populations within the landscape, with studies showing that bat activity and species diversity is negatively correlated with proximity to major roads (Berthinussen & Altringham, 2012) (Claireau *et al,* 2008). Barrier and edge effects associated with infrastructure, together with traffic collision, are key factors in this (Altringham & Kerth, 2016).

11.9.29 Constructing the River Wensum Viaduct may cause temporary disruption of commuting routes through disturbance (though no in-channel works would directly affect the River Wensum and habitats within the river valley). This would cause a short-term disturbance to foraging and commuting habitat and severance over a temporary period.

11.9.30 Two access tracks to be created between Ringland Lane and the River Wensum could cause additional severance. However, given that the tracks would be located close to the road, would be unlit, and lower speed limits would apply, these would not cause further fragmentation.

Barbastelle

11.9.31 The construction of the Proposed Scheme would involve the permanent loss of two assumed barbastelle day roosts. **Table 11-34** summarises roosts recorded within the Proposed Scheme survey extent that would be directly and indirectly impacted by construction works.

Table 11-34 Barbastelle Roosts Impacted by the Proposed Scheme

Roost Ref (ES)	Status	No. of Roosts	Impact
ES10, ES11, ES12, ES13, ES14, ES15, ES16, ES33, ES34, ES36, ES38	Primrose Grove Breeding Colony	11	Functional Loss via severance, and habitat degradation
ES03, ES04, ES05, ES08, ES09, ES17, ES18, ES19, ES26, ES27, ES37	Broadway / Telegraph Hill Breeding Colony	11	Functional Loss via severance, and habitat degradation

Roost Ref (ES)	Status	No. of Roosts	Impact
ES98, ES99	Day Roost (Assumed)	2	Loss
ES37	Day Roost	1	Disturbance

11.9.32 One maternity roost (ES34) falls within the Site Boundary at the location of temporary storage areas. This roost is being retained.

11.9.33 As the Proposed Scheme passes through the Nursery Woodland, a commuting route between Primrose Grove and Rose Carr will be severed, resulting in the fragmentation of roosting resource for the Primrose Grove colony, and between roosting resource and foraging areas. Areas of peripheral foraging areas for the Primrose Grove colony will be cleared to facilitate construction. Additionally, construction activities will result in the habitat degradation of core and peripheral foraging areas for the Primrose Grove colony (**Appendix 11.2: 2021 Bat Radio-Tracking Survey Report** (Document Reference: 3.11.02)) due to noise, vibration, and lighting. The maximum foraging radii recorded for individuals tracked from this colony ranged between 1.8 to 2.7 kilometres, with a mean CSZ of 2.6 kilometres, under half the distance noted within the current guidance (Collins, 2023). There is a range of suitable foraging, commuting and roosting habitats available within the 6 kilometres surrounding the Primrose Grove colony that fall outside of the Site Boundary. However, these combined impacts have the potential to result in the functional loss (behavioural changes resulting in the abandonment of confirmed roosts and / or roost resource) of the Primrose Grove colony.

11.9.34 Commuting routes for the Broadway / Telegraph Hill colony would be severed along the Broadway, Foxburrow Plantation and along the edge of Foxburrow Plantation. Areas of peripheral foraging areas for the Broadway / Telegraph Hill colony would be cleared to facilitate construction. Additionally, construction activities would result in the habitat degradation of core and peripheral foraging areas for the Broadway / Telegraph Hill colony due to noise, vibration, and lighting. There is a range of suitable foraging, commuting and roosting habitats available within the 6 kilometres surrounding the Broadway / Telegraph Hill colony that fall outside of the Site Boundary. However, these combined impacts have the potential to result in the functional loss of the Broadway / Telegraph Hill colony.

11.9.35 Further barbastelle colonies (Roarr! Dinosaur Park, Royal Norwich Golf Course and Felthorpe Colonies) would be adversely affected by the Proposed Scheme, via fragmentation and severance adding additional pressures on commuting bats, inclusive of pregnant and lactating females, and degradation of foraging and roosting habitats.

11.9.36 With the aforementioned literature and compiled survey data in mind, together with the good quality habitats within and immediately adjacent to the Site Boundary, the extant barbastelle colonies surrounding the Proposed Scheme, would be adversely impacted by the Proposed Scheme. Given that Embedded Mitigation and associated landscape mitigation measures have been selected to align with known commuting routes for barbastelle, the installation of these measures would reduce the longer-term risks associated with fragmentation and isolation. However, in the absence of Additional Mitigation, the Proposed Scheme would result in the reduction of the overall roosting resource utilised by the extant colonies, would result in a loss of available foraging habitat, and would cause habitat degradation, which could result in the functional loss of two barbastelle colonies (Primrose Grove and the Broadway / Telegraph Hill).

11.9.37 In the absence of Additional Mitigation, the construction of the Proposed Scheme has the potential to lead to the mortality and / or injury of barbastelle

during tree-felling works, disturbance of barbastelle during tree-felling and construction activities (i.e. piling), and habitat loss and / or damage or degradation.

Significance of Effect

11.9.38 The mortality and / or injury of individual barbastelle during the site clearance and construction works represents a permanent, direct, long-term impact that would result in a significant negative effect at a District scale in the absence of mitigation.

11.9.39 The loss and disturbance of barbastelle roost resource during the construction period represents both a direct permanent and temporary effect, with effects of disturbance being reversible and short term. In combination, the loss and disturbance of roost resource would result in a significant negative effect at County scale in the absence of mitigation.

11.9.40 The loss and degradation of barbastelle foraging habitat during the construction phase represents a direct / indirect, permanent, and temporary, reversible, and short / medium-term impact that would result in a significant negative effect at District scale in the absence of mitigation.

11.9.41 The severance of barbastelle flightlines and associated fragmentation of habitat during the construction phase represents a direct, temporary, reversible, and short / medium-term impact that would result in a significant negative effect at County scale in the absence of mitigation.

Brown long-eared bat

11.9.42 The construction of the Proposed Scheme would involve the permanent loss of three brown long-eared roosts. **Table 11-35** summarises brown long-eared bat roosts recorded within the Proposed Scheme survey extent that would be directly and indirectly impacted by construction works.

Table 11-35 Brown long-eared bat roosts impacted by the Proposed Scheme

Roost Reference (ES)	Status	No. of Roosts	Impact
ES42 and ES70	Day Roost	2	Loss
ES43	Maternity	1	Loss
ES44	Day Roost	1	Damaged
ES52	Hibernation	1	Temporary closure

11.9.43 One hibernation roost (ES53) falls within the Site Boundary; however, this would be retained and no impacts on this roost are anticipated following mitigation implementation.

11.9.44 The Proposed Scheme would sever commuting features linking brown long-eared roosts to foraging habitat. Additionally, the Proposed Scheme would result in the loss of peripheral habitat and degradation of core foraging habitat for brown long-eared bats.

11.9.45 With the aforementioned literature and compiled survey data in mind, together with the good quality habitats within and immediately adjacent to the Site Boundary, the extant brown long-eared bat population surrounding the Site Boundary will be adversely impacted by the Proposed Scheme. Brown long-eared bat is a noise- and light-sensitive species, further increasing the impacts associated with the Proposed Scheme.

11.9.46 Given that the placement of the Embedded Mitigation and associated landscape mitigation measures, has been selected to align with known commuting routes, the installation of these measures would reduce the risks associated with fragmentation and isolation. However, in absence of Additional Mitigation, the Proposed Scheme would result in the loss of known roosts, reduce the overall roosting resource utilised by the extant colonies, would result in a loss of available foraging habitat and cause habitat degradation. Brown long-eared bats tend to have smaller home ranges (CSZ of 3 kilometres, (Collins, 2023)) and higher levels of roost fidelity. Therefore, colonies have less opportunity to expand their range to counter the negative effects associated with development.

11.9.47 In the absence of Additional Mitigation, the construction of the Proposed Scheme has the potential to lead to the mortality and / or injury of brown long-eared bats during tree-felling works, disturbance of brown long-eared bat during construction activities (i.e. piling), and habitat loss and / or damage or degradation.

Significance of Effect

11.9.48 The mortality and / or injury of brown long-eared bat during the site clearance and construction works represents a permanent, direct, long-term impact that would result in a significant negative effect at Local scale in the absence of mitigation.

11.9.49 The loss and disturbance of brown long-eared bat roost resource during the construction period represents both a direct permanent and temporary effect, with effects of disturbance reversible and short-term. In combination, the loss and disturbance of roost resource would result in a significant negative effect at Local scale in the absence of mitigation.

11.9.50 The loss and degradation of brown long-eared bat foraging habitat during the construction phase represents a direct / indirect, permanent, and temporary, reversible, and short / medium term impact that would result in a significant negative effect at Local scale in the absence of mitigation.

11.9.51 The severance and fragmentation of brown long-eared bat flightlines and associated fragmentation of habitat during the construction phase represents a temporary, reversible, and short / medium-term impact that would result in a significant negative effect at District scale in the absence of mitigation.

***Myotis* species**

11.9.52 The construction of the Proposed Scheme would involve the permanent loss of two *Myotis* species hibernation roosts. This was a single tree (Tree 103), containing a single *Myotis* at the time of survey. On a precautionary basis, it is assumed to support a single hibernating Natterer's bat and a single hibernating Daubenton's bat as the species was unconfirmed. **Table 11-36** summarises *Myotis* species roosts recorded within the Proposed Scheme survey extent that will be directly and indirectly impacted by construction works.

Table 11-36 Myotis species roost impacted by the Proposed Scheme

Roost Reference (ES)	Status	Species	No. of Roosts	Impact
ES65	Hibernation	Daubenton's bat	1	Loss
ES65	Hibernation	Natterer's bat	1	Loss
ES52	Hibernation	Daubenton's bat	1	Temporary closure

11.9.53 The Proposed Scheme would sever commuting features linking *Myotis* roosts to foraging habitat. Additionally, the Proposed Scheme would result in the loss of and degradation of foraging habitat for *Myotis* species.

11.9.54 With the aforementioned literature and compiled survey data in mind, together with the good quality habitats within and immediately adjacent to the Site Boundary, the extant *Myotis* species bat population surrounding the Site Boundary, would be adversely impacted by the Proposed Scheme. Given that Embedded Mitigation and associated landscape mitigation measures have been selected to align with known commuting routes, the installation of these measures would reduce the longer term risks associated with fragmentation and isolation. However, in absence of Additional Mitigation, the Proposed Scheme would result in the loss of known roosts, reduce the overall roosting resource utilised by the extant colonies, would result in a loss of available foraging habitat and cause habitat degradation. Daubenton's bat tend to have smaller home ranges (CSZ of 1 kilometre (Collins, 2023), though confidence in the Daubenton's bat CSZ assessment is considered poor). Therefore, Daubenton's bat colonies have less opportunity to expand their range to counter the negative effects associated with development. However, with avoidance and reduction of impacts to the River Wensum, associated foraging habitats would still be located within the vicinity of the Proposed Scheme. In addition, there is opportunity for individuals to expand their territories both up and down stream. Natterer's bats, with a CSZ of 3 kilometres (Collins, 2023) are likely to be less affected.

11.9.55 In the absence of Additional Mitigation, the construction of the Proposed Scheme has the potential to lead to the mortality and / or injury of *Myotis* species during tree felling works, disturbance of *Myotis* species during construction activities (i.e. piling), and habitat loss and / or damage or degradation.

Significance of Effect

11.9.56 The mortality and / or injury of *Myotis* species during the site clearance and construction works represents a permanent, direct, long-term impact that would result in a significant negative effect at Local scale in the absence of mitigation.

11.9.57 The loss and disturbance of *Myotis* species roost resource during the construction phase represents both a direct permanent and temporary effect, with effects of disturbance being reversible and short term. In combination, the loss and disturbance of roost resource would result in a significant negative effect at Local scale in the absence of mitigation.

11.9.58 The loss and degradation of *Myotis* species foraging habitat during the construction phase represents a direct / indirect, permanent, and temporary, reversible, and short / medium-term impact that would result in a significant negative effect at Local scale in the absence of mitigation.

11.9.59 The severance of *Myotis* species flightlines and associated fragmentation of habitat during the construction phase represents a direct, temporary, reversible, and short / medium-term impact that would result in a significant negative effect at District scale in the absence of mitigation.

Soprano Pipistrelle

11.9.60 The construction of the Proposed Scheme would involve the loss of eight soprano pipistrelle roosts. A hibernating *pipistrellus* species was recorded within a single tree (ES78) that would be subject to disturbance during construction. Given that the *pipistrellus* species supported within this tree is unknown, it is assumed to support a single hibernating soprano pipistrelle and a single hibernating common pipistrelle. **Table 11-33** summarises soprano pipistrelle roosts recorded within the Proposed Scheme survey extent that would be directly and indirectly impacted by construction works.

Table 11-37 Soprano Pipistrelle Roosts to be Impacted by the Proposed Scheme

Roost Reference (ES)	Status	No. of Roosts	Impact
ES71, ES73, ES74, ES75, ES76, and ES77	Day	6	Loss

Roost Reference (ES)	Status	No. of Roosts	Impact
ES75	Hibernation	1	Loss
ES79	Maternity	1	Loss
ES78	Hibernation	1	Disturbance

11.9.61 Three other day roosts (ES87, ES88 and ES89) fall within the Site Boundary, however, these would be retained and no impacts on these roosts are anticipated following mitigation implementation.

11.9.62 The Proposed Scheme would sever commuting features linking soprano pipistrelle roosts to foraging habitat. Additionally, the Proposed Scheme would result in the loss of and degradation of foraging habitat for soprano pipistrelle bats.

11.9.63 With the aforementioned literature and compiled survey data in mind, together with the good quality habitats within and immediately adjacent to the Site Boundary, the extant soprano pipistrelle bat population surrounding the Site Boundary, would be adversely impacted by the Proposed Scheme. Given that Embedded Mitigation and associated landscape mitigation measures have been selected to align with known commuting routes, the installation of these measures would reduce the longer term risks associated with fragmentation and isolation. However, in the absence of Additional Mitigation, the Proposed Scheme would result in the loss of known roosts, reduce the overall roosting resource utilised by the extant colonies, and would result in a loss of available foraging habitat and cause habitat degradation.

11.9.64 In the absence of Additional Mitigation, the construction of the Proposed Scheme has the potential to lead to the mortality and / or injury of soprano pipistrelle during tree-felling works, disturbance of soprano pipistrelle during construction activities (i.e. piling), and habitat loss and / or damage or degradation.

Significance of Effect

11.9.65 The mortality and / or injury of soprano pipistrelle during the site clearance and construction works represents a permanent, direct, long-term impact that would result in a significant negative effect at Site scale in the absence of mitigation.

11.9.66 The loss and disturbance of soprano pipistrelle roost resource during the construction phase represents both a direct permanent and temporary effect, with effects of disturbance being reversible and short term. In combination, the loss and disturbance of roost resource would result in a significant negative effect at scale Site in the absence of mitigation.

11.9.67 The loss and degradation of soprano pipistrelle foraging habitat during the construction phase represents a direct / indirect, permanent, and temporary, reversible, and short / medium-term impact that would result in a significant negative effect at Site scale in the absence of mitigation.

11.9.68 The severance and fragmentation of soprano pipistrelle flightlines and associated fragmentation of habitat during the construction period represents a direct, temporary, reversible, and short / medium-term impact that would result in a significant negative effect at Local scale in the absence of mitigation.

Operational Phase

11.9.69 No additional habitat loss or fragmentation would take place during the operation phase. The likely significant effects for extant bat populations associated with the operational phase are set out below.

Collision Risks

11.9.70 The retention of existing habitats and the provision of replacement habitats in proximity to the Proposed Scheme poses a risk, notably to lower flying species that are susceptible to traffic collision injury and mortality. Barrier and edge effects associated with infrastructure, together with traffic collision, are key factors in species diversity within the vicinity of major roads (Altringham & Kerth, 2016).

11.9.71 While some species, including barbastelle, have been shown to readily cross open spaces above roads, the presence of a road can increase the risk of road traffic collision and the design of the Proposed Scheme has sought to minimise this risk (Kerth & Melber, 2009). There is also data that indicates that bats would continue to cross above roads on known commuting routes in the absence of specific mitigation (structures). Therefore, these locations need to be designed to encourage safe movement (above the traffic corridor) where bats do continue to cross (Claireau et al,, 2008).

11.9.72 The Proposed Scheme would result in the increased risk of mortality and / or injury of bat species via collision with vehicles. Given that Embedded Mitigation and associated landscape mitigation measures have been selected to align with known commuting routes, the installation of these measures would reduce the risks associated with collision. Additionally, landscape treatments have been embedded into the Proposed Scheme design, where the road is in cutting. These locations are where the Proposed Scheme passes through woodland blocks where the alignment cannot accommodate green bridge / underpass designs. The purpose is to encourage safe movement (above the traffic corridor) should bats continue to cross between woodland parcels. Dense scrub and / or fencing is incorporated into the design to aid the safe movements.

Habitat Degradation

11.9.73 Habitat quality may also reduce due to traffic. Vehicle noise has been shown to reduce foraging efficiency for some species (those that rely on listening to prey rather than using echolocation, e.g., brown long-eared bats). However, the effects are short range, and any deterrence effect may help to reduce collision risk.

11.9.74 **Chapter 10: Biodiversity Appendix 10.34** (Document Reference: 3.10.00) presents the assessment of potential effects of air quality changes at sites of ecological importance resulting from the operation of the Proposed Scheme.

11.9.75 Of the 44 sites assessed, the Proposed Scheme is concluded to have moderate and above adverse effects on the following sites:

- Primrose Grove Ancient Woodland - N deposition (moderate adverse - 2029 and 2044) NH_3 (large adverse - 2029 and 2044);
- Broom and Spring Hills CWS - NH_3 (moderate adverse - 2029 and 2044);
- Fakenham Road RNR - N deposition (moderate adverse - 2029 and 2044) NH3 (moderate adverse - 2029 and 2044)
- Land Adjoining Foxburrow Plantation CWS – N-dep (moderate adverse - 2029 and 2044) and NH3 (moderate adverse - 2029 and 2044);
- Primrose Grove CWS - NH_3 (moderate adverse - 2029 and 2044);
- River Wensum Pastures CWS- N deposition (moderate adverse – 2029 and 2044) and NH_3 (moderate adverse - 2029 and 2044), NOx (moderate adverse –2044); and
- Wensum Pastures at Morton Hall CWS- NH_3 (moderate adverse – 2029 and 2044).

11.9.76 All of the above receptor sites support foraging and commuting bats. Additionally, Land Adjoining Foxburrow Plantation CWS and Primrose Grove Ancient Woodland and CWS have been surveyed and confirmed to support roosting resource and confirmed roosts.

11.9.77 Of the 73 veteran and / or ancient trees assessed, the Proposed Scheme is concluded to have moderate adverse effects i.e., significant effects on the following 12 trees:

- T13 (T277), T12 (T278), T11 (T279), T3 (T268), T10 (T281), T24 (T105), T23 (T45), T16 (T99), T19 (T74), and T9 (T295) – NH3 (moderate adverse - 2029 and 2044).

- T26 (T152), T25 (T113) , T18 (T72), T17 (T96), T6 (T160), and T21 (T34) – NH3 (moderate adverse – 2044 only).

11.9.78 All of the above trees are within the roosting resource of the extant bat populations within the Site Boundary.

11.9.79 As detailed within **Chapter 10: Biodiversity Appendix 10.34**(Document Reference: 3.10.00), the impacts of nitrogen deposition and increases in NH_3 and NOx concentrations to those designated habitats within 200 metres of the Proposed Scheme are considered to be 'irreversible'.

11.9.80 Modelled changes in air quality during the operational phase may result in a degradation of retained habitat for bats through loss or reduced prey biomass. The extent of degradation would be influenced by a number of factors including Additional Mitigation.

11.9.81 However, all sites modelled are currently exceeding the critical level and load for N deposition and NH_3 and are predicted to continue exceeding the critical level and load for NH_3 and N deposition regardless of the Proposed Scheme.

11.9.82 No sites or ancient / veteran trees within the assessment were found to have significant beneficial effects in 2029 or 2044 as a result of the Proposed Scheme, although a number of non-significant beneficial effects were identified.

11.9.83 Of the 44 sites and 73 veteran trees assessed, the following sites and trees will result in a reduction in N deposition, NH3 and / or NOx levels that exceeds 1% of critical load due to the Proposed Scheme. Therefore, it is considered that the following sites would experience a slight beneficial effect.

- Attebridge Hills CWS;
- Botany Bay Farm CWS;
- Brook House Marshes CWS;
- Church Hill Common CWS;

- Costessey Pits (East) CWS;
- Earlham and Colney Marshes CWS;
- East Hills CWS;
- Hellesdon Pastures CWS;
- Horsham Meadows CWS;
- Intwood Carr CWS;
- Jennis' Wood & Dryhill Plantation CWS;
- Meadow Farm Meadow CWS;
- Mouse Wood CWS;
- Old Covert, Wood Lane CWS;
- Snake Wood Ancient Woodland;
- Sweetbriar Road Meadows, Norwich SSSI;
- Taverham Mill CWS;
- Weston Meadow CWS; and
- T46.

11.9.84 Of the above sites and veteran tree, 13 sites are located within the core sustenance zone of barbastelle, 11 are within the core sustenance zones of Natterer's bat, 10 are within the core sustenance zones of brown long-eared bat and soprano pipistrelle, and nine are within the core sustenance zones of Daubenton's bat and common pipistrelle populations within the Site Boundary. The sites all form part of the available foraging habitat within the respective core sustenance zones used by bat populations within the Site Boundary.

11.9.85 The extent of lighting to be installed has been minimised as far as possible. Lighting is only to be installed at two locations along the Proposed Scheme, at

the A47 / the Proposed Scheme junction in the south of the Site Boundary, and A1067 / the Proposed Scheme junction in the north of the Site Boundary.

11.9.86 As detailed within the (Lighting Design Plan (Document Reference: 02.09.00), the Proposed Scheme would be subject to minimal operational lighting. At the A1067 / the Proposed Scheme junction, the only lighting being installed on and leading up to / from the roundabout, which will consist of illuminated type LED sign lights. The LED sign lights will be installed directly onto the street side and face down to illuminate the sign only, rather than the environment surrounding the sign. This allows for minimal light spill to the side of the signs, and no light spill above the signs.

11.9.87 Bats, including barbastelle, have been recorded crossing the existing Fakenham Road during VP and radio-tracking surveys undertaken for the Proposed Scheme. Due to the minimal lighting being installed at the new junction, it is not considered that this will have an adverse impact on bat commuting.

11.9.88 At the A47 / the Proposed Scheme junction, eight 10 metre high lighting columns would be installed (six for the Proposed Scheme, and two for the A47 DCO). These lights are being installed approximately 300 metres south of the closest confirmed roost (brown long-eared bat day roost) and not within an area identified of importance for commuting and foraging bats. Due to the minimal lighting being installed at the new junction, it is not considered that this would have an adverse impact on bat commuting.

11.9.89 Within the remaining areas of the Proposed Scheme, no artificial lighting is being installed and the only anticipated night-time lighting impacts are from vehicle headlights. Solid screens would be installed above underpasses to stop light spill from vehicles on the road above deterring bats from entering the underpasses. Solid screens are also being installed along green bridges parapets, to avoid light incursion from the vehicles below deterring bats from crossing them.

Barbastelle

11.9.90 The Proposed Scheme would result in habitat degradation of core and peripheral foraging habitat for barbastelle, due to air quality impacts. The maximum foraging radii recorded for individuals tracked from this colony ranged between 1.8 to 2.7 kilometres, with a mean CSZ of 2.6 kilometres, under half the average CSZ described within current guidance (Collins, 2023). There is a range of suitable foraging, commuting habitats available within the 6 kilometres surrounding the Primrose Grove colony and the Broadway / Telegraph Hill colony that fall outside of the Site Boundary, including 1670ha of deciduous woodland mapped on the Natural England HPI layer within MAGIC.

11.9.91 With the aforementioned literature and compiled survey data in mind, together with the good quality habitats within and immediately adjacent to the Site Boundary, the extant barbastelle bat population surrounding the Site Boundary would be adversely impacted by the Proposed Scheme.

11.9.92 In the absence of Additional Mitigation, the construction of the Proposed Scheme has the potential to lead to the mortality, and / or injury of barbastelle and habitat damage or degradation.

Significance of Effect

11.9.93 The mortality and / or injury of barbastelle via vehicle collision represents a permanent, direct, long-term impact that would result in a significant negative effect at County scale in the absence of mitigation.

11.9.94 A significant negative effect is predicted extending from the construction phase in to operational as a result of loss and disturbance of foraging resource until the habitat creation and compensation measures have reached their target condition. Direct / indirect, temporary, reversible, and short / medium-term impact that would result in a significant negative effect at District scale in the absence of Additional Mitigation.

11.9.95 The degradation of barbastelle habitat represents an indirect, irreversible, and long-term impact that would result in a significant negative effect at County scale in the absence of mitigation.

Brown long-eared bat

11.9.96 The Proposed Scheme would result in habitat degradation of core and peripheral foraging habitat for brown long-eared bats, due to air quality impacts. Brown long-eared bats tend to have smaller home ranges (CSZ of 3 kilometres, (Collins, 2023)) and therefore have less opportunity to expand their range to counter the negative effects associated with development.

11.9.97 With the aforementioned literature and compiled survey data in mind, together with the good quality habitats within and immediately adjacent to the Site Boundary, the extant brown long-eared bat population surrounding the Site Boundary, would be adversely impacted by the Proposed Scheme.

11.9.98 In the absence of Additional Mitigation, the construction of the Proposed Scheme has the potential to lead to the mortality, and / or injury of brown long-eared bats and habitat damage or degradation.

Significance of Effect

11.9.99 The mortality and / or injury of brown long-eared bat via vehicle collision represents a permanent, direct, long-term impact that would result in a significant negative effect at Local scale in the absence of mitigation.

11.9.100 A significant negative effect is predicted extending from the construction phase in to operational as a result of loss and disturbance of foraging resource until the habitat creation and compensation measures have reached their target condition. Direct / indirect, temporary, reversible, and short / medium-term impact that would result in a significant negative effect at Local scale in the absence of Additional Mitigation.

11.9.101 The degradation of brown long-eared bat habitat represents an indirect, irreversible, and long-term impact that would result in a significant negative effect at Local scale in the absence of mitigation.

***Myotis* sp.**

11.9.102 The Proposed Scheme would result in habitat degradation of foraging habitat for *Myotis* species, due to air quality impacts. Daubenton's bat tend to have smaller home ranges (CSZ of 1 kilometre (Collins, 2023), though confidence in the Daubenton's bat CSZ assessment is considered poor). Therefore, Daubenton's bat colonies have less opportunity to expand their range to counter the negative effects associated with development. However, with avoidance and reduction of impacts to the River Wensum, associated foraging habitats would still be located within the vicinity of the Site Boundary. Natterer's bat, with a CSZ of 3 kilometres (Collins, 2023) have more availability to expand their range into adjacent habitats.

11.9.103 With the aforementioned literature and compiled survey data in mind, together with the good quality habitats within and immediately adjacent to the Site Boundary, the extant *Myotis* species population surrounding the Site Boundary, would be adversely impacted by the Proposed Scheme.

11.9.104 In the absence of Additional Mitigation, the construction of the Proposed Scheme has the potential to lead to the mortality, and / or injury of *Myotis* species and habitat damage or degradation,.

Significance of Effect

11.9.105 The mortality and / or injury of *Myotis* species via vehicle collision represents a permanent, direct, long-term impact that would result in a significant negative effect at Local scale in the absence of mitigation.

11.9.106 A significant negative effect is predicted extending from the construction phase in to operational as a result of loss and disturbance of foraging resource until the habitat creation and compensation measures have reached their target condition. Direct / indirect, temporary, reversible, and short / medium-term impact that would result in a significant negative effect at Local scale in the absence of Additional Mitigation.

11.9.107 The degradation of *Myotis* species habitat represents an indirect, irreversible, and long-term impact that would result in a significant negative effect at Local scale in the absence of mitigation.

Soprano pipistrelle

11.9.108 The Proposed Scheme would result in habitat degradation of foraging habitat for soprano pipistrelle, due to air quality impacts. Additionally, the Proposed Scheme would result in an increased risks of mortality and / or injury.

11.9.109 With the aforementioned literature and compiled survey data in mind, together with the good quality habitats within and immediately adjacent to the Site Boundary, the extant soprano pipistrelle population surrounding the Site Boundary, would be adversely impacted by the Proposed Scheme.

11.9.110 In the absence of Additional Mitigation, the construction of the Proposed Scheme has the potential to lead to the mortality, and / or injury of soprano pipistrelle and habitat damage or degradation.

Significance of Effect

11.9.111 The mortality and / or injury of soprano pipistrelle via vehicle collision represents a permanent, direct, long-term impact that would result in a significant negative effect at Site scale in the absence of mitigation.

11.9.112 The degradation of soprano pipistrelle habitat represents an indirect, irreversible, and long-term impact that would result in a significant negative effect at Site scale in the absence of mitigation.

11.10 Additional Mitigation and Enhancement Measures

11.10.1 This section sets out the design, mitigation and enhancement measures which are likely to be required to avoid, prevent, reduce or, if possible, offset any identified significant adverse effects on bats.

Mitigation

11.10.2 The mitigation hierarchy has been followed to avoid / minimise loss of roosts, foraging and commuting habitats, and avoid sensitive periods when bats are more vulnerable to disturbance, where possible.

11.10.3 The OBMS provided in **Appendix 11.6** (Document Reference: 3.11.06) details the Additional Mitigation measures, which are summarised below.

- production of and adherence to a tree-felling protocol;
- provision of compensatory roosting resource in the form of bat boxes and creation of veteran features as shown on **Figure 11.26, Appendix 11.10** (Document Reference: 3.11.10)**;**
- TFLs to be installed where known flightpaths will be removed;
- adherence to a Bat Noise Monitoring and Management Plan (BNMMP);
- adherence to a Construction Lighting Management Plan (CLMP) pursuant to the OCEMP;
- habitat creation and improvement measures to account for habitat losses as shown on **Figure 11.26, Appendix 11.10** (Document Reference: 3.11.10); and
- habitat improvement measures to account for air quality impacts through the **Air Quality Compensation Strategy** (Document Reference: 6.01.00).

11.10.4 The finalisation of this strategy will sit alongside the production of the bat EPSML required for the Proposed Scheme and detailed below.

11.10.5 Additionally, an OCEMP is to be produced for the Proposed Scheme. Measures applicable to each of the Important Ecological Features are summarised below.

European Protected Species Licence

11.10.6 To comply with conservation legislation and protect bat species across the Proposed Scheme, an EPSML and associated mitigation and compensation will be required in advance of construction. Subject to agreement with NE as part of the final EPSML application, mitigation and compensation required will include (but is not limited to):

- Timing of works: for the capture and exclusion of bats, and the removal of the roosts (and potential roosts) prior to proposed works, the timing of bat-sensitive periods will be taken into consideration. This would include the avoidance of loss of maternity roosts during maternity period (taken to be May to August, inclusive; however, local, and annual variances to be taken into consideration).
- A toolbox talk will be provided to all site contractors throughout the construction period, to outline the proposed works, actions to take if a bat is encountered and their legal responsibility regarding bats and their roosts.
- Capture and Exclusion - any licensable works will be directly supervised by the Named Ecologist (or their Accredited Agent). All capture and exclusion methods will be detailed within the EPSML licence, including a felling protocol. These would include hand-removal of suitable roosting features (if possible) and / or exclusion using 'one-way' exclusion device on all features which cannot be removed by hand or confirmed as 'bat-free.' These methods will be supplemented by the use of dusk and / or dawn surveys as appropriate (if considered safe to undertake).
- The use of TFLs during construction period and until vegetation along permanent commuting features has matured, if required.

11.10.7 Further mitigation and compensation features that will be required as part of the EPSML application are detailed within the Embedded Mitigation section (**Section 9**) and below.

Bat Roosting Features

11.10.8 All known roosts to be destroyed, damaged or disturbed would be compensated with two boxes, inclusive of temporary loss. See the OBMS provided in **Appendix 11.6** (Document Reference: 3.11.06) for full details.

11.10.9 In addition to the above and in recognition of roost-switching behaviour, roost compensation is provided for all low, moderate, and high suitability trees within the woodland impacted due to the permanent loss of the roosting resource. This includes the precautionary approach trees (ES98, ES99 detailed within **Figure 11.08, Appendix 11.10** (Document Reference: 3.11.10)), which are being treated as confirmed barbastelle day roosts within this assessment, as detailed within **paragraph 11.6.17**.

11.10.10 Ratios for bat box numbers and creation of veteran features is detailed in **Table 11-38**.

Table 11-38 Roost Resource Compensation Ratios

Roost feature type (existing confirmed roost or PRF)	**Minimum replacement ratio (roost mitigation feature: roost loss)**
Confirmed roost (trees and structures)	2:1
Precautionary approach trees (assumed roosts)	2:1
High suitability tree	1:1
Moderate suitability tree	1:2
Low suitability tree	1:5

11.10.11 The lower ratio proposed for low suitability trees is appropriate for the loss of currently unsuitable features that could develop in the future, as decay progresses. Not all such features are likely to develop into suitable features.

11.10.12 Bat boxes would be installed prior to the felling of confirmed roosts and trees with moderate or high suitability for which they are designed to compensate. Creation of veteranisation features would commence once access has been confirmed in the Red Line Boundary and be completed by the end of construction year 1.

11.10.13 Additionally, if a known roosting feature or potential roosting feature can be retained and recycled, it would be used within the compensation methods. If possible, features would be removed and relocated on a tree within the Compensation Extent. It would be placed at a similar height and orientation to its original location, as per recommendations within the UK Bat Mitigation Guidelines (Reason & Wray, 2023). The size, location, state of decay would all be taken into consideration when deciding whether it is suitable to use a feature. Additionally, health and safety would be considered as the feature should only be used if it can be attached to a new tree safely. This approach would be assessed ahead of completion.

11.10.14 The OBMS follows the roost resource approach (Davidson-Watts and Hinds, 2022). Therefore, in addition to the compensation detailed within **OBMS (**Document Reference: 3.11.07) **Table 3-2**, if a roost is subsequently identified within the woodland resource trees, compensation for that tree would be amended to follow the agreed ratio for a confirmed roost, as detailed within **Table 11-38**. For example, if a roost is recorded within a moderate suitability tree, two bat boxes would be installed.

Severance and Fragmentation

11.10.15 In addition to those features embedded into the Proposed Scheme, TFLs would be installed where known flightpaths would be removed which could result in significant adverse effects. This would include known bat flightpaths that would be severed during construction, prior to the construction of a permanent mitigation feature (green bridge, underpass, landscape treatment). TFLs would also be used for short-duration severance including temporary severance of a flightpath to a known roost during the site clearance timeframes, where required.

11.10.16 The type of TFL used would be dependent on the duration it is required for, and the requirement for construction works in the vicinity of the feature (i.e. temporary removal / relocation during the day).

11.10.17 The following principles would be applied to all TFL options:

- gaps along linear features would be as small as possible not exceed 3m without agreement with the Named Ecologist;
- any gaps required to complete overnight works would be agreed with the Named Ecologist and would typically not exceed 3 metres;
- flightpaths would be straight or sinuous (no sharp turns);
- flightpaths would be a minimum of 2 metres in height (containerised plants and other methods may be used to provide increased height, where appropriate), and would aim to mimic the original flightline;
- no direct artificial lighting of TFL and associated retained habitat. If temporary lighting is required within the vicinity of the TFL, lighting controls would used to minimise impacts;
- the TFLs would be located as close to the original flightline location as the construction activities allow. Any change in location of the TFL to ease construction would be determined by the Named Ecologist; and
- the design for TFLs would be selected in response to construction needs in specific locations. Where features must be regularly moved to allow daytime construction activities to proceed, typically lighter options would be selected, in locations / at times where only infrequent movement is required heavier solutions may be feasible. The ability to move the temporary features is important to enable construction to proceed and to allow for modification in response to bat behaviour.

11.10.18 All TFLs designs will be agreed with the Named Ecologist, prior to the severance of any bat flightlines. The type of flightline will be dependent on the existing landscape present at the flightline, and the type and duration of construction activities occurring at each feature. TFLs will be removed only once the Named Ecologist has confirmed that the permanent design (for example landscape planting), is functioning to provide habitat connectivity.

Noise and vibrational disturbance

11.10.19 As an addition to Embedded Mitigation measures to minimise the effects of noise and vibrational disturbance, the Proposed Scheme OCEMP outlines measures that should be taken to reduce the risk of noise and vibration disturbance during the construction phase.

11.10.20 These construction noise-related impacts should be considered for the higher-risk activities such as piling as part of the production and implementation of the BNMMP, to be prepared for submission with the final bat EPSML. The BNMMP will include relevant measures to avoid and / or reduce effects on bats. The BNMMP would be completed by the EPSML Named Ecologist to determine suitable measures and buffers are implemented for works in vicinity of retained roosts.

11.10.21 Piling is occurring at a number of locations along the Site Boundary where structures are being built. This includes the River Wensum Viaduct, retaining wall at Primrose Grove and the four green bridges. For each piling location, a 50-metre assessment buffer will be applied, as part of the BNMMP.

11.10.22 This BNMMP will take into consideration bats and their roosts. Sensitive areas such as the Northern Woodlands, the Broadway and Foxburrow plantation will all be subject to individual assessments. The principles of the approach are detailed in **Table 11-39**.

Table 11-39 Principles of Noise Mitigation Approach

Mitigation Approach	Description
Managing the times during which noise is produced.	Focused on known roosts and roost resource within Northern Woodlands, the Broadway, and Foxburrow Plantations, as these contain roosts of high conservation significance. Where relevant and feasible, seasonal timing of works would aim to avoid sensitive periods for roosting bats, specifically the maternity season (typically between May and early August, weather dependent) and hibernation (typically the core period is between November to March, weather dependent). However, in certain locations it may be possible to commence works prior to these sensitive periods and continue into them. If this approach is taken compensatory roosting resource would be required, as detailed below.
Locate noise-generating activities away from receptors	Move as many of the noise generating activities outside of the 50m buffer of these roosts / roost resource as possible. Although it is noted that some activities, including piling are required in fixed locations within the Site Boundary.

Mitigation Approach	Description
Reducing the noise at source (barriers, different types of plant).	Where practicable, use of barriers for noise created by equipment, such as for small-scale plant; locations of receptors and the likely effectiveness of screening should be assessed before incurring costs. Some plant is inherently less noisy: e.g. vibrating rather than percussive pile-drivers. An example is the Giken 'silent piling' rig. For the unit tested, measured levels did not exceed ~35 dB LZeq, T at frequencies between ~5-80 kHz, even at distances of 5m, which would not cause significant disturbance. However, while this type of piling has lower noise emissions, it is not suitable in all circumstances (much slower and more expensive). It could be used, even in proximity to roosts, if timing restrictions aren't practicable.
Compensating for lack of access to resources (roosts or foraging areas) should these be affected to the extent that they are no longer attractive to bats, resulting in abandonment or avoidance.	The EPSML will include disturbance of high conservation significance roosts e.g. maternity, hibernation, mating and Annex II species, and disturbance of the wider roosting resource. PRFs which could be used by maternity colonies within 25m of the piling locations will be included within the EPSML compensation calculation, by provision of bat boxes at a 1:1 ratio, ahead of works commencing.

Lighting

11.10.23 A CLMP will be produced in advance of the works, describing the best practice techniques (ILP, 2023) that will be deployed to minimise impacts from lighting.

11.10.24 This CLMP will include the following:

- maximising work during daylight hours to minimise the need for evening / night working;
- keeping lighting levels as low as is practical and safe;
- controlling location and direction to reduce overspill beyond working areas or upwards;
- avoiding light spillage onto areas of ecological importance for example, the ancient woodland, Primrose Grove;
- avoiding all direct lighting of known bat flightlines and TFLs and reducing light-spillage as much as possible using best practice techniques; and
- use of appropriate LEDs and other best practice techniques in site compounds and work areas.

11.10.25 The CLMP will be reviewed by an Ecologist to determine suitable measures and buffers are implemented for works in vicinity of retained roosts and will be drafted in advance of a full EPSML submission.

Habitats

11.10.26 The full details of the habitat creation and improvements are detailed within the OBMS provided in **Appendix 11.6** (Document Reference: 3.11.06). A summary of the approach is detailed below.

Woodland Creation

11.10.27 Semi-natural woodland would be replaced and / or created at a 3:1 (creation : loss) area ratio, to include planting within the Site Boundary and the wider Red Line Boundary (See **Figure 11.26, Appendix 11.10** (Document Reference: 3.11.10)). This habitat creation and habitat improvement will:

- increase woodland connectivity through the landscape, with locations adjacent or closely connected to existing woodland (avoiding isolated pockets);
- include a proportion of new and improved woodland within the core and peripheral foraging zones of barbastelle colonies affected by the Proposed Scheme;
- create, in the longer term, closed canopy broadleaved woodland containing a range of broadleaved tree and shrub species of various ages providing high structural diversity;
- avoid loss of existing habitat of elevated nature conservation value, meaning woodland creation sites will typically comprise arable or species-poor grassland; and
- create and enhance habitats suitable for invertebrate species on which bats prey with the intention of increasing the abundance of prey species.

11.10.28 Given the above replacement ratio, the current woodland area creation target is 30.03ha.

Woodland Improvements

11.10.29 In time, newly planted and improved areas would provide suitable habitat for foraging and roosting bats; however, woodland creation is a lengthy process and for this reason, to mitigate changes in the net availability of habitat to the local bat population in the short to medium term, additional woodland improvement is proposed. This woodland improvement is at a 1:1 ratio. Therefore, a minimum of 10.01ha additional woodland would be improved, to provide additional habitat resource during the construction phase and the period required for new habitat to become established.

Hedgerow

11.10.30 Hedgerow replacement would be at a ratio of over 2:1 (creation : loss), to include planting within the Red Line Boundary. Given the hedgerow

replacement ratio, currently the length of hedgerow creation required is 16.95 kilometres. This creation, improvement, management, and maintenance would be further outlined in the LEMP.

11.10.31 The hedgerow network represents an important component of the foraging and commuting habitat available to the local bat assemblage, and improvement of existing hedgerows is proposed to strengthen and connect the wider habitat network used by bats within the Red Line Boundary.

Riparian Habitats

11.10.32 As part of the wider ecological mitigation strategy (**Ecological Mitigation Strategy** (Document Reference: 3.10.32)), works within the floodplain would include the creation and improvement of drainage ditches primarily to benefit water voles *Arvicola amphibius* and Desmoulin's whorl snail *Vertigo moulinsiana*. This habitat creation and improvement would also benefit bats that forage in association with riparian habitat which include barbastelle, noctule, serotine, Leisler's bat, and Nathusius' pipistrelle. In addition, habitat improvement is proposed along the Foxburrow Stream corridor to the south of Foxburrow Plantation.

Other information

11.10.33 Measures to be mandated by their inclusion in the Proposed Scheme **Outline Arboricultural Mitigation Strategy** (Document Reference: 3.03.01d) would include protection measures for retained habitats. Retained trees and hedgerow must be protected in accordance with British Standard BS5837:2012 Trees in Relation to Construction, including the erection of robust protective fencing encompassing root protection areas.

11.10.34 The location and proposals for compensatory habitats and enhancement measures have also been informed by use of the NE Biodiversity Metric 3.1 as part of a Biodiversity Net Gain assessment. This metric assigns relative values to habitats depending on a range of factors such as distinctiveness, condition, and scarcity. The metric then combines these factors with the area of each habitat impacted, to provide a score for the number of Biodiversity

Units lost. The results of the biodiversity net gain assessment are detailed in **Appendix 33: Biodiversity Net Gain Technical Report** (Document Reference: 3:10.33).

11.10.35 All new landscape / habitat creation would be subject to a long term (30 year) management and maintenance plan through the LEMP. The management plan would prescribe the maintenance regimes for all different landscape / habitats considering the aims, objectives, and functions of each area of planting / habitat. The management plan would also set out proposals for monitoring the condition of landscape and habitat creation areas, to ensure these meet their target condition / objectives.

Air Quality

11.10.36 A series of measures to address potential impacts on air quality during construction have been identified. These are detailed in **Table 6-12** of **Chapter 6: Air Quality** (Document Reference: 3.06.00).

11.10.37 Measures to prevent dust and other emissions from construction affecting the retained habitats and land beyond the Proposed Scheme have been mandated by their inclusion in the Proposed Scheme **OCEMP Chapter 3 Appendix 3.1: OCEMP** (Document Reference: 3.03.01).

11.10.38 Compensation opportunities for reaching target conditions of CWS within the air quality study area during the operational phase, inclusive of Primrose Grove ancient woodland and CWS, Wensum Pastures at Morton Hall CWS, Broom & Spring Hills CWS, and land adjacent to Foxburrow Plantation CWS are detailed within the **Air Quality Compensation Strategy** (Document Reference: 6.01.00) and further summarised in the OBMS provided in **Appendix 11.6** (Document Reference: 3.11.06). These compensation opportunities are primarily focussed on reducing air quality impacts, however, the opportunities listed will in addition be beneficial to reducing the air quality impacts on bat populations.

11.10.39 As detailed within **Air Quality Compensation Strategy** (Document reference: 6.01.00), once the compensation measures have been assessed for their

viability, and confirmed through the Final Air Quality Compensation Strategy, all proposed enhancements including an appropriate monitoring strategy will be set out in the LEMP.

11.11 Assessment of Significant Effects

11.11.1 This section details the assessment of likely significant effects taking account of the Additional Mitigation detailed in **Section 10** of this chapter above.

Construction Phase

11.11.2 Mitigation measures included in the OCEMP, EPSML and OBMS (see **Section 10** of this chapter) would reduce the effects of accidental mortality and / or injury of bats during tree felling works, loss of known roosts and roosting resource, habitat degradation on features to negligible levels. This includes impacts such as:

- Mortality and / or injury of bats during the loss of supporting habitats;
- Disturbance through construction via noise and vibration;
- Disturbance or severance of commuting routes or foraging areas due to floodlighting used during night works; and
- Degradation of foraging habitats within and adjacent to the Site Boundary due to losses and disturbances.

11.11.3 The significance of these effects on features, therefore, is predicted to be not significant during construction (see **Table 10-14** - Summary of biodiversity Effects) unless stated otherwise per feature below.

Habitat Loss, Fragmentation and Severance

11.11.4 In the longer term, the habitat creation described within **Section 10** of this chapter would compensate for habitat loss during the construction phase by providing alternative, suitable habitat for foraging and roosting bats. However, woodland establishment is a lengthy process. A number of factors including weather and management regimes would influence the timeframes to the newly created woodland maturing. For this reason, woodland improvement is

also provided as set out in **Section 10**, to minimise the net reduction in availability of foraging habitat during the construction phase.

11.11.5 Similarly, features designed to mitigate habitat fragmentation including green bridges and underpasses include a landscape element which requires time to become established and function as intended. In the short to medium term, TBF would be utilised to mitigate effects upon bat activity. There is limited evidence documenting the effectiveness of these features, and therefore some uncertainty remains.

Barbastelle

11.11.6 Following the successful implementation of the measures set out in **Section 10** of this chapter, a significant negative effect at the District scale is predicted during the construction phase as a result of loss and disturbance of foraging resource until the habitat creation and compensation measures have reached their target condition. Following establishment, effects are expected to be not significant.

11.11.7 A significant negative effect at the County scale is also predicted during the construction phase as a result of severance of barbastelle flightlines and associated fragmentation of habitat until mitigation, notably the landscaping of green bridge and underpass features, has become functional. Following establishment, effects are expected to be not significant.

Brown Long-eared Bat

11.11.8 Following the successful implementation of the measures set out in **Section 10**, a significant negative effect at the Local scale is predicted during the construction phase as a result of loss and disturbance of foraging resource until the habitat creation and compensation measures have reached their target condition. Following establishment, effects are expected to be not significant.

11.11.9 A significant negative effect at the District scale is also predicted during the construction phase as a result of severance of brown long-eared flightlines and associated fragmentation of habitat until mitigation, notably the

landscaping of green bridge and underpass features, has become functional. Following establishment, effects are expected to be not significant.

***Myotis* Species**

11.11.10 Following the successful implementation of the measures set out in **Section 10** of this chapter, a significant negative effect at the Local scale is predicted during the construction phase as a result of loss and disturbance of foraging resource until the habitat creation and compensation measures have reached their target condition. Following establishment, effects are expected to be not significant.

11.11.11 A significant negative effect at the District scale is also predicted during the construction phase as a result of severance of Myotis flightlines and associated fragmentation of habitat until mitigation, notably the landscaping of green bridge and underpass features, has become functional. Following establishment, effects are expected to be not significant.

Soprano pipistrelle

11.11.12 Following the successful implementation of the measures set out in **Section 10** of this chapter, a significant negative effect at the Local scale is predicted during the construction phase as a result of severance and fragmentation of habitat until the habitat creation and compensation measures have reached their target condition. Following establishment, effects are expected to be not significant.

11.11.13 A significant negative effect at the Local scale is also predicted during the construction phase as a result of severance of Myotis flightlines and associated fragmentation of habitat until mitigation, notably the landscaping of green bridge and underpass features, has become functional. Following establishment, effects are expected to be not significant.

Operational Phase

Vehicle Collision Risk and Habitat Severance

11.11.14 The green bridges, underpasses and associated landscape designs have been designed in accordance with the most recent scientific research, and principles of design. Flightlines and flight height influenced the location, structure, width, and horizontal alignment of each green bridge design. Additionally, the use of the 'instant' hedgerows, will provide connectivity at the point of installation. The success of these features would be dependent upon multiple factors, including those which are controllable factors (the management regime) and external factors (adverse weather).

11.11.15 A number of research papers have shown positive responses for bats and green bridges and underpasses and confirmed use (Berthinussen & Altringham 2015; Martínez-Medina et al., 2022; Laforge et al., 2019, Claireau et al., 2019). However, there is limited evidence available, and some uncertainty remains.

Air Quality Habitat Impacts

11.11.16 In the longer term, the habitat improvements included within **Section 10** of this chapter, would compensate for air quality impacts. Therefore, in time, newly planted woodland habitat would provide suitable habitat for foraging and roosting bats; however, woodland creation is a lengthy process. A number of factors, including weather and management regimes, would influence the timeframes to the newly created woodland maturing.

Barbastelle

11.11.17 Following the successful implementation of the measures set out in **Section 10** of this chapter, a significant negative effect at the County scale is predicted during the operational phase as a result of mortality and / or injury of individual barbastelle resulting from vehicle collision until mitigation, notably the landscaping of green bridge and underpass features, has become functional. Following establishing, effects are expected to be not significant.

11.11.18 A significant negative effect at the District scale is predicted extending from the construction phase in to operational as a result of loss and disturbance of foraging resource until the habitat creation and compensation measures have reached their target condition. Following establishment, effects are expected to be not significant.

11.11.19 A significant negative effect at the County scale is predicted during the operational phase as a result of habitat degradation until the habitat creation and compensation measures have reached their target condition. Following establishment, effects are expected to be not significant.

Brown Long-eared Bat

11.11.20 Following the successful implementation of the measures set out in **Section 10** of this chapter, a significant negative effect at the Local scale is predicted during the operational phase as a result of mortality and / or injury of individual bats resulting from vehicle collision until mitigation, notably the landscaping of green bridge and underpass features, has become functional. Following establishment, effects are expected to be not significant.

11.11.21 A significant negative effect at the Local scale is predicted extending from the construction phase in to operational as a result of loss and disturbance of foraging resource until the habitat creation and compensation measures have reached their target condition. Following establishment, effects are expected to be not significant.

11.11.22 A significant negative effect at the Local scale is predicted during the operational phase as a result of habitat degradation until the habitat creation and compensation measures have reached their target condition. Following establishment, effects are expected to be not significant.

Myotis Species

11.11.23 Following the successful implementation of the measures set out in **Section 10** of this chapter, a significant negative effect at the Local scale is predicted during the operational phase as a result of mortality and / or injury of individual bats resulting from vehicle collision until mitigation, notably the

landscaping of green bridge and underpass features, has become functional. Following establishment, effects are expected to be not significant.

11.11.24 A significant negative effect at the Local scale is predicted extending from the construction phase in to operational as a result of loss and disturbance of foraging resource until the habitat creation and compensation measures have reached their target condition. Following establishment, effects are expected to be not significant.

11.11.25 A significant negative effect at the Local scale is predicted during the operational phase as a result of habitat degradation until the habitat creation and compensation measures have reached their target condition. Following establishment, effects are expected to be not significant.

Soprano pipistrelle

11.11.26 Following the successful implementation of the measures set out in **Section 10** of this chapter, a significant negative effect at the Local scale is predicted during the operational phase as a result of mortality and / or injury of individual bats resulting from vehicle collision until mitigation, notably the landscaping of green bridge and underpass features, has become functional. Following establishment, effects are expected to be not significant.

Table 11-40 Summary of Biodiversity Effects – Construction and Operational Phases

Key to table:

P/T = Permanent or Temporary, D/I = Direct or Indirect, ST/MT/LT = Short Term, Medium Term or Long Term, N/A = Not Applicable

Period	Receptor	Potential Effects including Embedded Mitigation	Significance of Effects Prior to Additional Mitigation	Additional Mitigation	Significance of Effects Following Additional Mitigation
Construction	Barbastelle	Injury and mortality	Significant negative at the District scale P/D /LT	Use of felling protocol for trees. Licensed works. Precautionary Method of Working for vegetation clearance, lighting regimes etc.	Not significant

Period	Receptor	Potential Effects including Embedded Mitigation	Significance of Effects Prior to Additional Mitigation	Additional Mitigation	Significance of Effects Following Additional Mitigation
Construction	Barbastelle	Loss and disturbance of roosting resource	Significant negative at the County scale P/T /I /ST	Compensatory roosting resource. Noise and vibration reduction measures. Lighting reduction and control measures.	Not significant
Construction	Barbastelle	Habitat loss and degradation	Significant negative at the District scale T/ D/I / MT	Reinstatement, creation, and enhancement of habitats within the Red Line Boundary.	Significant negative effect at the District scale and not significant once target condition reached. T/ D/I / MT

Period	Receptor	Potential Effects including Embedded Mitigation	Significance of Effects Prior to Additional Mitigation	Additional Mitigation	Significance of Effects Following Additional Mitigation
Construction	Barbastelle	Severance and fragmentation	Significant negative at the County scale T/ D / MT	Licensed works. Reinstatement, creation, and enhancement of habitats within the Red Line Boundary. Creation of green bridges and underpasses.	Significant negative effect at the County scale and not significant once landscape features have become functional. T/ D / MT

Period	Receptor	Potential Effects including Embedded Mitigation	Significance of Effects Prior to Additional Mitigation	Additional Mitigation	Significance of Effects Following Additional Mitigation
Construction	Brown long-eared bat	Injury and mortality	Significant negative at the Local scale P/D /LT	Use of felling protocol for trees. Licensed works. Precautionary Method of Working for vegetation clearance, lighting regimes etc.	Not significant
Construction	Brown long-eared bat	Loss and disturbance of roosting resource	Significant negative at the Local scale P/T /I /ST	Compensatory roosting resource. Noise and vibration reduction measures. Lighting reduction and control measures.	Not significant

Period	Receptor	Potential Effects including Embedded Mitigation	Significance of Effects Prior to Additional Mitigation	Additional Mitigation	Significance of Effects Following Additional Mitigation
Construction	Brown long-eared bat	Habitat loss and degradation	Significant negative at the Local scale T/D/I /MT	Reinstatement, creation, and enhancement of habitats within the Red Line Boundary.	Significant negative effect at the Local scale and not significant once target condition reached. T/ D/I / MT

Period	Receptor	Potential Effects including Embedded Mitigation	Significance of Effects Prior to Additional Mitigation	Additional Mitigation	Significance of Effects Following Additional Mitigation
Construction	Brown long-eared bat	Severance and fragmentation	Significant negative at the District scale T/ D / MT	Licensed works. Reinstatement, creation, and enhancement of habitats within the Red Line Boundary. Creation of green bridges and underpasses.	Significant negative effect at the District scale and not significant once landscape features have become functional. T/ D / MT

Period	Receptor	Potential Effects including Embedded Mitigation	Significance of Effects Prior to Additional Mitigation	Additional Mitigation	Significance of Effects Following Additional Mitigation
Construction	Myotis species	Injury and mortality	Significant negative at the Local scale P/D /LT	Use of felling protocol for trees. Licenced works. Precautionary Method of Working for vegetation clearance, lighting regimes etc.	Not significant.
Construction	Myotis species	Loss and disturbance of roosting resource	Significant negative at the Local scale P/T /I /ST	Compensatory roosting resource. Noise and vibration reduction measures. Lighting reduction and control measures.	Not significant.

Period	Receptor	Potential Effects including Embedded Mitigation	Significance of Effects Prior to Additional Mitigation	Additional Mitigation	Significance of Effects Following Additional Mitigation
Construction	Myotis species	Habitat loss and degradation	Significant negative at the Local scale T/D/I /MT	Reinstatement, creation, and enhancement of habitats within the Red Line Boundary.	Significant negative effect at the Local scale and not significant once target condition reached. T/ D/I / MT
Construction	Myotis species	Severance and fragmentation	Significant negative at the District scale T/ D / MT	Licensed works. Reinstatement, creation, and enhancement of habitats within the Red Line Boundary. Creation of green bridges and underpasses.	Significant negative effect at the District scale and not significant once landscape features have become functional.

Period	Receptor	Potential Effects including Embedded Mitigation	Significance of Effects Prior to Additional Mitigation	Additional Mitigation	Significance of Effects Following Additional Mitigation
Construction	Soprano pipistrelle	Severance and fragmentation	Significant negative at the Local scale T/ D / MT	Licensed works. Reinstatement, creation, and enhancement of habitats within the Red Line Boundary. Creation of green bridges and underpasses.	Significant negative effect at the Local scale and not significant once landscape features have become functional.

Period	Receptor	Potential Effects including Embedded Mitigation	Significance of Effects Prior to Additional Mitigation	Additional Mitigation	Significance of Effects Following Additional Mitigation
Operational	Barbastelle	Injury and mortality	Significant negative at the County scale P/ D / LT	Licenced works. Reinstatement, creation, and enhancement of habitats within the Red Line Boundary. Creation of green bridges and underpasses.	Significant negative effect at the District scale and not significant once landscape features have become functional. P/ D / MT

Period	Receptor	Potential Effects including Embedded Mitigation	Significance of Effects Prior to Additional Mitigation	Additional Mitigation	Significance of Effects Following Additional Mitigation
Operational	Barbastelle	Habitat loss and degradation	Significant negative at the District scale T/ D/I / MT	Reinstatement, creation, and enhancement of habitats within the Red Line Boundary.	Significant negative effect at the District scale and not significant once target condition reached. T/ D/I / MT
Operational	Barbastelle	Air Quality habitat degradation	Significant negative at the County scale T/ I /LT	Enhancement of habitats within the Red Line Boundary.	Significant negative effect at the District scale and not significant once target condition reached. T/ I / LT

Period	Receptor	Potential Effects including Embedded Mitigation	Significance of Effects Prior to Additional Mitigation	Additional Mitigation	Significance of Effects Following Additional Mitigation
Operational	Brown long-eared bat	Injury and mortality	Significant negative at the Local scale	Licensed works. Reinstatement, creation, and enhancement of habitats within the Red Line Boundary. Creation of green bridges and underpasses.	Significant negative effect at the Local scale and not significant once landscape features have become functional. P/ D / MT
Operational	Brown long-eared bat	Habitat loss and degradation	Significant negative at the Local scale T/ D/I / MT	Reinstatement, creation, and enhancement of habitats within the Red Line Boundary.	Significant negative effect at the Local scale and not significant once target condition reached. T/ D/I / MT

Period	Receptor	Potential Effects including Embedded Mitigation	Significance of Effects Prior to Additional Mitigation	Additional Mitigation	Significance of Effects Following Additional Mitigation
Operational	Brown long-eared bat	Air Quality habitat degradation	Significant negative at the Local scale T/ I /LT	Enhancement of habitats within the Red Line Boundary.	Significant negative effect at the Local scale and not significant once target condition reached. T/ I / LT
Operational	Myotis species	Injury and mortality	Significant negative at the Local scale P/ D / LT	Licenced works. Reinstatement, creation, and enhancement of habitats within the Red Line Boundary. Creation of green bridges and underpasses.	Significant negative effect at the Local scale and not significant once landscape features have become functional. P/ D / MT

Period	Receptor	Potential Effects including Embedded Mitigation	Significance of Effects Prior to Additional Mitigation	Additional Mitigation	Significance of Effects Following Additional Mitigation
Operational	Myotis species	Habitat loss and degradation	Significant negative at the Local scale T/D/I /MT	Reinstatement, creation, and enhancement of habitats within the Red Line Boundary.	Significant negative effect at the Local scale and not significant once target condition reached. T/ D/I / MT
Operational	Myotis species	Air Quality habitat degradation	Significant negative at the Local scale T/ I /LT	Enhancement of habitats within the Red Line Boundary.	Significant negative effect at the Local scale and not significant once target condition reached. T/ I / LT

11.12 Cumulative Effects

11.12.1 The assessment of cumulative impacts from nearby committed developments is included within **Appendix 11.8** (Document Reference: 3.11.08). Significance of effect is addressed in **Chapter 20: Cumulative Assessment** (Document Reference: 3.20.00).

11.12.2 This section considers the potential effects in-combination with other projects (the inter-project assessment) that are likely to arise as a result of the Proposed Scheme in combination with the identified committed schemes (outlined in **Chapter 20: Cumulative Assessment** (Document Reference: 3.20.00)) on sensitive ecological receptors for bat populations. The following committed developments are considered to be of a scale and nature to have potential in-combination effects:

- A47 North Tuddenham to Easton (A47 DCO);
- Hornsea Project Three Offshore Wind Farm;
- Sheringham and Dudgeon Extension Projects; and
- Roarr! Dinosaur Attraction Expansion.

11.12.3 The inter-project assessment considers the potential for each project to influence the sensitive receptor being considered. In order for a cumulative effect to arise, the nature of two effects does not necessarily have to be the same. Potential cumulative effects considered below comprise impacts to the local bat population assessed within the impact assessment.

11.12.4 A full list of nearby committed developments long and shortlisted for consideration in the in-combination and cumulative effects assessment of this Environmental Statement specific to bats is provided in **Appendix 11.8** (Document Reference: 3.11.08).

Rationale for projects considered in the Cumulative Impact Assessment in relation to Bats

A47 North Tuddenham to Easton (A47 DCO)

11.12.5 In August 2022 National Highways received DCO (Development Consent Order) approval from the Secretary of State for Transport to dual the A47 between North Tuddenham and Easton, replacing the existing single carriageway link. This DCO approval was subsequently subject to an appeal. The appeal was dismissed further to a hearing in the Court of Appeal in January 2024.

11.12.6 The consented A47 DCO involves dualling of the A47 by National Highways, lies to the south of the Site Boundary. When developed it would connect to the Proposed Scheme at its southern extent. The dualling of the A47 will introduce dualling of the single carriageway section of the A47 between Norwich and Dereham, linking together two existing sections of dual carriageway. The A47 DCO will provide a new route to the south of Hockering and to the north of Honingham and include two new junctions. The first junction will be at Berry's Lane and Wood Lane, and the second junction will be located at Blind Lane and Norwich Road. Because of these additions to the side roads, the Easton roundabout will be removed.

11.12.7 Bat surveys were undertaken to inform the A47 DCO, which included bat roost surveys (both summer and hibernation) and activity surveys (Highways England 2021b, Highways England 2022b).

11.12.8 A total of 14 roost trees were identified as being destroyed to facilitate the construction of this development, comprising common pipistrelle day roosts, a soprano pipistrelle day roost and a Myotis species day roost. No maternity or hibernation roosts were identified as being lost. However, indirect disturbance was identified for one brown long-eared bat maternity roost.

11.12.9 Chapter 8: Biodiversity of the A47 North Tuddenham to Easton Dualling (Highways England, 2021a) identifies that severance of bat commuting habitat, as a result of the A47 DCO Scheme, has potential to impact bat populations and describes mitigation including hop-over planting and targeted planting at underpasses and overpasses designed to facilitate safe bat movement across the road. The ES concludes that "*it is unknown whether mitigation at underpasses, overpasses and the River Tudd Crossing to enable bats to fly safely across the new road will work until monitoring surveys are complete. As such, on a precautionary basis the impact has been concluded to be major adverse due to the potential for permanent damage to populations*."

11.12.10 This development is adjacent to the Site Boundary, and the construction of the A47 dualling is likely to take place alongside the construction of the Proposed Scheme. This could result in cumulative impacts and effects on bat populations which depend on habitat affected by both schemes.

Hornsea Project Three Offshore Wind Farm

11.12.11 Hornsea Project Three is 2 kilometres from the Site Boundary on the west-side of Attlebridge and includes the installation of an electricity cable, which will cross the River Wensum. The onshore cable corridor crosses the Site Boundary between Ringland Lane and Weston Road. The construction of this development will commence in 2023, with the laying of onshore cables from year 2 to year 4.

11.12.12 Baseline bat surveys to inform the DCO application did not identify bat roosts within the Study Areas for bats relevant to the Proposed Scheme (these Study Areas are defined within **Table 11-5**) (Thomson Ecology,2018b). Activity surveys identified that certain hedgerows, beyond the Red Line Boundary, but within the installation corridor for Hornsea Project Three were of value for commuting bats. Where hedgerows of value to commuting bats are severed by the project, mitigation is incorporated to include the use of temporary flightlines to maintain connectivity prior to hedgerow reinstatement (Thomson Ecology,2018a).

11.12.13 Replacement planting of hedgerows is to be implemented during the first planting season following the completion of construction works for Hornsea Project Three. The ES for the scheme identified a minor adverse impact upon the local bat population in the short-medium term resulting from habitat loss and / or severance for bats (Thomson Ecology,2018b).

11.12.14 There are four locations where Hornsea Project Three requires hedgerow clearance within the Red Line Boundary, assuming each severance is a maximum of 80m in width (on a precautionary basis), this equates to 320 metre hedgerow loss. This includes 160 metres of hedgerows along an access route at Ringland Lane, and 80 metres of hedgerow at an access route along Blackbreck Lane. The remaining 80m is at the hedgerow north of Weston Road, where a green bridge (Morton green bridge) is being created as part of the Proposed Scheme.

11.12.15 The development intersects with the Site Boundary and the temporal overlap of construction phases could result in cumulative impacts upon bats associated with changes to habitat availability.

Equinor Sheringham Shoal & Dudgeon Wind Farm Extension Project.

11.12.16 These two offshore windfarm projects have a joint export cable system, offshore and onshore, connecting to the national grid transmission network at Norwich Main substation. The onshore cable would intersect the Site Boundary and will cross the River Wensum approximately 1.5 kilometres to the north-west of the Site Boundary.

11.12.17 Baseline bat surveys to inform the DCO application did not identify bat roosts within the Study Areas for bats relevant to the Proposed Scheme (these Study Areas are defined within **Table 11-5**). Bat activity surveys were completed that sampled activity levels near the River Wensum (Wild Frontier Ecology 2022a and 2022b).

11.12.18 Following the ES, a Technical Note (Bats - Alderford Common SSSI and Swannington Upgrade Common SSSI (Royal HaskoningDHV, 2023)) was produced responding to queries raised about potential construction impacts associated with habitat severance on bats in the areas around Attlebridge Common SSSI (located 2.4 kilometres north-west of the Site Boundary) and Swannington Upgrade Common SSSI (located 2.2 kilometres north of the Site Boundary). Further pre-construction surveys of the hedgerows connecting these two SSSIs will be undertaken (assuming they are confirmed as needing to be partially removed / breached at that stage) to ensure impacts are appropriately considered and mitigated.

11.12.19 Approximately 4 kilometres of the 22 kilometres of hedgerows that occur within the 60 kilometere onshore cabling route will be cleared. The remainder of the hedgerows will be crossed using trenchless techniques to avoid clearance. Where a hedgerow will be severed, the gap will be a maximum of 20 metres. No details are currently available on the specific locations of hedgerow clearance and woodland clearance within the Site Boundary.

11.12.20 The development crosses hedgerows in multiple locations within, or near to the Red Line Boundary. In the absence of specific locations for clearance, on a precautionary basis, it is assumed that there will be partial clearance along a hedgerow north of Weston Road, and along Weston Road and at the Broadway. This clearance will be temporary, with any hedgerow clearance areas replanted within the following planting season.

11.12.21 The Environmental Statement confirms that the development has been designed to avoid crossing woodlands and areas or groups of trees, where possible (BSG, 2020). Furthermore, where avoiding woodland has not been possible, that clearance will be avoided as far as possible through the use of trenchless crossing techniques during cable installation. For this reason, it is reasonably assumed that woodland adjacent to the Broadway will not be directly impacted.

11.12.22 The high-level construction programme provided in the Environmental Statement for this development (BSG, 2022) indicates a construction start year of 2025, with the onshore elements undertaken from 2025 – 2027.

11.12.23 The development intersects with the Site Boundary and the temporal overlap of construction phases could result in cumulative impacts upon bats associated with changes to habitat availability.

Roarr! Dinosaur Attraction Expansion

11.12.24 This development includes an extension to existing facilities at the Roarr! Dinosaur Adventure to provide a themed attraction centred around a volcano-themed ride, located on land to the north-west of the existing facility.

11.12.25 Bat surveys to inform the application included a preliminary roost appraisal of woodland and bat activity surveys. Radio-tracking data obtained from NBSG was also considered in the Environmental Statement for this development. The development area contains habitat which forms part of the commuting and foraging resource for the Roarr! Dinosaur Park and Royal Norwich Golf Course barbastelle colonies.

11.12.26 The Roar! Dinosaur Adventure expansion will not directly impact potential bat roost trees; however, the Environmental Statement identifies the risk for changes to foraging habitat availability in the absence of mitigation. Mitigation is proposed to include enhancement of retained habitats and other actions to reduce the risk of disturbance to bats, to include minimising lighting and sources of noise after dark. The Environmental Statement concludes that, during the construction stage, the effects upon bats generally will be negligible; however, minor impacts upon barbastelle through noise and lighting disturbance would occur. During the operational phase, the Environmental Statement predicts minor impacts upon the local bat population including barbastelle.

11.12.27 The Proposed Scheme is within the core sustenance zone of the barbastelle population affected by this development, and there is temporal overlap between the schemes. This could result in cumulative impacts and effects on bat populations which depend on habitat affected by both schemes.

Assessment of Cumulative Impacts

11.12.28 The below sections provide an assessment of the potential level of impact following the potential for cumulative impacts stated above.

11.12.29 The following publicly available documents informed the below assessment:

- Environmental Statement chapters for the Equinor - Sheringham and Dudgeon Extension Projects (BSG Ecology, 2022) (Wild Frontier Ecology, 2022a)(Wild Frontier Ecology, 2022b);
- Environmental Statement chapters for the A47 North Tuddenham to Easton;
- Environmental Statement chapters for the Hornsea Project Three Offshore Wind Farm (Thomson Ecology, 2018a) (Thomson Ecology, 2018b);
- Bats - Alderford Common SSSI and Swannington Upgrade Common SSSI (Royal HaskoningDHV, 2023); and
- Environmental Statement chapters for the Roar! Dinosaur Attraction Expansion (Norfolk Dinosaur Park Ltd (2021).

Construction

11.12.30 The Proposed Scheme, and the four projects listed above, have the potential to cumulatively impact the local barbastelle population during the construction period.

11.12.31 The potential for cumulative impacts, is associated with changes to commuting and foraging habitat resource and landscape permeability. There is no reason to believe there would be cumulative effects upon roosting resource, the respective Environmental Statements confirm that no potential barbastelle roosts relevant to the Proposed Scheme Study Areas would be affected. Additionally, all projects listed would be required to mitigate effects to confirmed roosts used by other species to satisfy relevant legal protection.

11.12.32 Both the Hornsea Project Three cabling scheme and Equinor Sheringham Shoal & Dudgeon Wind Farm Extension Project require temporary hedgerow removal to facilitate installation. This has already commenced (Hornsea Project Three) for certain sections spanning the Red Line Boundary. Therefore, it can be reasonably anticipated that replacement planting would be installed during the planting period 2023 / 24 or 2024 / 25. Whilst planting would require a number of years to establish, any partial gaps in hedgerow would likely be insignificant in the context of the wider hedgerow network within the core sustenance zone of barbastelle colonies, Myotis species, brown long-eared bat, and soprano pipistrelle CSZ. For this reason, cumulative effects associated with these schemes are not likely.

11.12.33 The Roarr! Dinosaur Attraction Expansion is predicted to result in minor effects upon the Roarr! Dinosaur Park / Royal Norwich Golf Course barbastelle colonies. Radio-tracking data shows limited movement of individuals from these colonies towards the Red Line Boundary. Although there is potential for the schemes to impact the same colonies given their proximity, it is not likely to alter the significance of predicted impacts because there is a degree of spatial separation between these barbastelle colonies and the Proposed Scheme.

11.12.34 The A47 DCO will involve habitat clearance as part of enabling works, to be largely completed in advance of the Proposed Scheme construction phase. It is assumed that habitat compensation, to include new planting, will be completed prior to the end of construction in 2025. However, this compensation will take time to establish, meaning that the net reduction in commuting and foraging habitat loss as a result of this scheme and the Proposed Scheme will overlap. During radio-tracking surveys for the Proposed Scheme, a barbastelle identified as part of the Broadway / Telegraph Hill colony was recorded foraging south of the existing A47 road. This indicates that effects upon habitat resulting from both schemes will impact the same barbastelle population. Although, brown long-eared bats were identified within the southern extent of the Proposed Scheme no movement was recorded within the vicinity of the of the existing A47 road. Foraging activity was recorded within the southern extent of the Proposed Scheme for Myotis species and brown long-eared bats. Additionally, similar habitat is within close proximity and to the south of the existing A47 road. Therefore, this indicates that effects upon habitat resulting from both schemes will impact the same Myotis species and brown long-eared bats populations.

11.12.35 The Proposed Scheme alone is predicted to result in a significant negative effect at the County scale on the barbastelle population and a significant negative effect at the District scale the Myotis and brown long-eared bat populations during the construction phase, until associated habitat creation and compensation measures have reached target condition. Cumulatively, alongside other schemes, there will be a greater net reduction in foraging habitat and habitat connectivity within habitat used by barbastelle colonies including Primrose Grove and Broadway / Telegraph Hill and Myotis and brown long-eared bat populations. Importantly, riparian habitat associated with the River Wensum will remain available, similarly habitat along the River Tudd. This may alter foraging and commuting behaviours, requiring individual bats to utilise areas to the north or east of the Proposed Scheme.

11.12.36 Similar mitigation measures are proposed for the respective schemes, including the provision of replacement habitat, which in each case will take time to establish. As the habitat reaches target condition, the significance of effects will reduce providing the affected colonies remain viable. The construction phase mitigation measures forming part of the Proposed Scheme, which include habitat enhancement (of existing woodland) and temporary flight lines, seek to ensure that net reduction in available habitat is minimised. The cumulative effect of these schemes upon the barbastelle population during the construction phase is different to the Proposed Scheme alone; however, remains significant at the County and District scales.

Operation

11.12.37 Mitigation to reduce impacts upon barbastelle, Myotis species and brown long- eared bat foraging and commuting habitat for both the A47 DCO and the Proposed Scheme, includes landscape planting. The establishment period for planting is expected to overlap temporally and given the duration, remain relevant to the operational phase of the Proposed Scheme.

11.12.38 The Proposed Scheme alone is predicted to result in a significant negative effect at the District scale on the barbastelle population and Local scale for Myotis and brown long-eared bat populations during the operational phase, until associated habitat creation and compensation measures have reached target condition. Considering the schemes cumulatively, there is a greater initial reduction in available foraging habitat, although this remains a small proportion of the total available habitat in the landscape. Although, the cumulative effect of these schemes upon the barbastelle, Myotis and brown long-eared bat populations during the operational phase is different to the Proposed Scheme alone, it remains significant at the Local scales, respectively, until habitat creation and compensation measures have reached target condition.

A1270 Broadland Northway (Norwich NDR)

11.12.39 The A1270 Broadland Northway runs 19.5 kilometres around the north of Norwich, from the A47 Junction at Postwick in the east, to the A1067 Fakenham Road in the west. Construction commenced in 2016 and the road was fully opened to traffic in April 2018. The operational phase of the A1270 Broadland Northway spans both the construction and operational phases of the Proposed Scheme. Whilst it therefore forms part of the baseline position, and is therefore not a 'cumulative' scheme in strict EIA terms, this chapter has considered them together in any event.

11.12.40 The A1270 Broadland Northway ES confirms impacts including the loss of ten bat roosts (used by species including brown long-eared bat, common pipistrelle, unidentified pipistrelle, Natterer's bat and noctule). It reports that none of the barbastelle roosts identified as a result of radio-tracking at the time would be directly affected by the scheme; however, that they may indirectly be affected due to the close proximity and potential for habitat severance. The ES concludes large adverse effects associated with the loss of roosts during the construction phase, lessening to slight adverse during operation (Y1) becoming neutral by year 15.

11.12.41 Fourteen identified flight lines used by barbastelle were identified to be directly affected by the A1270 Broadland Northway scheme (NDR ES, Table 53). Mariott's Way is reported to be the most significant (of greatest conservation value) as it was recorded to be consistently used by all species recorded to be present and of specific importance for barbastelle. The ES reports probable slight to large adverse effects upon bats as a result of habitat severance during construction, lessening to neutral to slight adverse during operation with the exception of Mariott's Way where large adverse effects would remain during year 1 lessening to neutral to slight adverse by year 15.

11.12.42 The ES notes that 'severance or disturbance of these routes will indirectly impact on identified roosts…by disrupting commuting routes between roosts and foraging ground.' The ES reports probable slight adverse effects upon indirectly affected roosts during construction, becoming neutral during operation.

11.12.43 Mitigation and compensation included the provision of replacement roosts, provision of crossing features (green bridges, bat gantries, modified accommodation bridges and tunnels / underpasses), an appropriate lighting scheme, habitat enhancements away from the scheme footprint to compensate for loss and possible degradation of habitat and monitoring during the operational phase to determine long-term residual impacts.

11.12.44 Monitoring was proposed for fifteen years to include static and manned monitoring of crossing features, collision surveys, roost surveys, and radio-tracking of barbastelle bats. Monitoring data to year 5 post construction is available at the time of writing and contributes to the understanding of current bat activity relevant to the A1270 Broadland Northway scheme. Activity and crossing feature monitoring data is most relevant when considering potential cumulative effects of this scheme, and the Proposed Scheme during the construction and operational phases.

11.12.45 The monitoring data confirms that at least ten species of bat are using the habitat either side of crossing features incorporated into the A1270 Broadland Northway scheme. Broadly, this is similar across the year one, two, three and five monitoring data with local variations in activity levels. Carcass searches have not recorded any bat fatalities. The manned crossing surveys, however, have recorded fewer bats crossing the scheme during year five overall compared to year three and no records of barbastelle bat crossing the road during year five (although they were recorded in small numbers during earlier years). This suggests that adverse effects have extended into the operational phase of the scheme as predicted in the ES. Since construction, in response to monitoring results, management measures have been implemented to address slow establishment of planting in association with crossing features.

Ongoing monitoring will record changes to bat activity as landscaping becomes further established.

11.12.46 Reduced habitat connectivity resulting from the A1270 Broadland Northway affects barbastelle colonies to the north, and potentially the Primrose Grove colony to the south, which is also affected by the Proposed Scheme. There is no data that suggests that the Proposed Scheme would impact colonies to the north of the A1270 Broadland Northway. As noted above in **paragraphs 11.12.29 to 11.12.37**, alone the Proposed Scheme is predicted to result in significant negative effects upon the barbastelle population during the construction and operational phases, until associated habitat creation and compensation measures have reached target condition. Although, factoring ongoing effects of the A1270 Broadland Northway upon the barbastelle population during the Proposed Scheme construction and operational phase is different to the Proposed Scheme alone, it remains significant at the County scale until habitat creation and compensation measures for the Proposed Scheme have reached target condition.

11.13 Monitoring

Overview

11.13.1 Bat ecological monitoring surveys would be required to assess the efficacy of the mitigation stated in **Section 9 and 10** of this chapter, and to confirm the findings of this impact assessment. It will establish whether mitigation and compensation measures are effective in maintaining the bat species present, including woodland specialists, at a favourable conservation status (FCS).

11.13.2 The OBMonS not only informs this assessment but will also form part of the suite of documents to inform the required EPSML application. Implementation would be overseen by the Named Ecologist and completed during and post-construction.

11.13.3 To ensure the aims of the OBMonS are met, five objectives, supported by defined actions, success indicators and required methods have been set, with details of how these will be achieved, as summarised within **Table 11-41**.

11.13.4 The monitoring strategy will include further detail on the recommended timeframes, detailed survey methods, potential constraints to surveys and assessment, roles and responsibilities, analysis and review of monitoring success and indicative proposals for remedial measures should certain thresholds for success not be met.

11.13.5 In order to secure completion of these monitoring requirements he Applicant is looking to obtain legally abiding landowner agreements. This is inclusive of landowners accepting compensation and mitigation to be installed and / or created on their land, and for land access agreements for the duration of the monitoring period for this strategy (ten years post-construction) to allow monitoring and maintenance as per these requirements. They will be sought in advance or alongside the planning application process. Where these agreements cannot be achieved, land required for compensation will be compulsorily purchased.

11.13.6 The above two factors influence the time frames in which access is to be gained, and therefore the implementation of compensatory measures.

Timeframes

11.13.7 To set a baseline for the high-frequency unweighted noise monitoring, surveys will be completed ahead of construction commencing.

11.13.8 Monitoring will commence during the construction stage and will continue for a minimum of ten years post-construction; monitoring activities may start at different times during this period. For the OBMonS, the post-construction monitoring timeframe will commence following the completion of all landscape planting.

Table 11-41 Monitoring Objectives, Tests and Survey Methods

Objective	Success measure	Survey methods	Expectations / tests	Indicative proposed remedial measures if tests not met
Objective 1: To ensure the distribution and breeding success status of bat populations within the Red Line Boundary is stable (or improved) compared to pre-construction	• the baseline assemblage of bat species recorded using bat boxes and other mitigation features remains consistent with baseline data • species composition, distribution, and breeding status of the bat assemblage remains consistent with baseline data.	Bat box checks	• bat box checks to record the same species as pre-construction; encounter rates increase over time as the boxes are adopted	• review the locations (and, over time, the condition) of bat boxes, and move them if appropriate. This remedial action would be informed by other survey techniques / findings. NB: it will take time for boxes to become adopted, so the remedial action should only be considered after boxes have been in place for at least three years.
Objective 1: As above	Success Measures as above	Veteran feature monitoring in trees, inclusive of hand netting a small number of individuals to assess breeding status	• veteran features are being used; at least some are used by breeding bats	• compare use of bat boxes with use of veteran features and levels of relative activity (static detectors) to ensure features are in the right areas of woodland. • If not, consider additional boxes and / or veteranisation. NB: it will take time for veteran features to become adopted, so the remedial action should only be considered after features have been in place for at least ten years.

Objective	Success measure	Survey methods	Expectations / tests	Indicative proposed remedial measures if tests not met
Objective 1: As above	Success Measures as above	Bat trapping	• trapping records the same species as pre-construction with similar encounter rates	• if species are 'missing,' or much more rarely encountered than at pre-construction, consider widening the area trapped. Use levels of relative activity (static detectors) to inform trapping location decisions; and • if species are present, but breeding appears less successful (smaller proportion of pregnant females or juvenile recruitment), review national / regional trends and environmental data to see if this is a scheme issue or a broader issue (in particular, climate-related).

Objective	Success measure	Survey methods	Expectations / tests	Indicative proposed remedial measures if tests not met
Objective 1: As above	Success Measures as above	Roost counts of retained roosts	• use of retained roosts is consistent with pre-construction levels of use • [note – this would be assessed across the roost resource, as not all tree roosts will be consistently re-used, particularly where features used were fragile]	• Woodland bats often exhibit fission-fusion behaviour, switching between roosts within the overall roost resource available. Therefore, the lack of reoccupation of a previously known roost should not be seen as a loss of roost as they may be roosting in the wider roost resource but can be used as a confirmation of presence. Therefore, loss of a singular roost should not be seen as a requirement for remedial action. Given the above, an assessment of roost resource across the Site Boundary should completed. • an assessment by the EPSML Named Ecologist of working methodologies and working hours in proximity to a higher conservation significance roost (to be revised if appropriate); • contractor to provide specific information in relation to noise from works in the vicinity of an important roost to the EPSML Named Ecologist for review; • review by the EPSML Named Ecologist of the changes in conditions surrounding an important roost pre-construction and during construction, to understand the extent of vegetation clearance to review if this has been undertaken in agreement with buffers and flightlines; and • TFLs may be installed to rectify temporary changes in roost access. NB: High conservation significance roosts are considered to be any Annex II species roost (excluding feeding perch), maternity or hibernation roost.

Objective	Success measure	Survey methods	Expectations / tests	Indicative proposed remedial measures if tests not met
Objective 1: As above	Success Measures as above	ASD monitoring	• static detectors record the same suite of species and similar levels of relative activity as pre-construction	• review of data to determine factors that may have decreased bat activity in particular location(s). Where a decrease has been noted, activity will be reviewed throughout the Red Line Boundary to establish if there are increases in activity at some locations that may account for decreases in others; • review of construction activities, to determine factors that may have deterred bat activity in affected locations; and • a review of noise data collected to provide assurance that noise levels are as predicted by the noise impact assessments and determine if any associated mitigation / restrictions are adequate or need modifying.

Objective	Success measure	Survey methods	Expectations / tests	Indicative proposed remedial measures if tests not met
Objective 2: To ensure that the mitigation ensures landscape permeability and safe crossing of the Proposed Scheme	• bats are using each feature / structure ('use' defined), in numbers which are similar to baseline use • bats are crossing the road at a 'safe' height, as confirmed using a night vision aid (NVA)	Vantage / crossing point surveys	• bats are following the TFLs and therefore their commuting routes are maintained noting that: • bat activity varies, even in the absence of construction; and • bats may prefer to use alternative (existing) commuting routes that they are familiar with in preference to TFLs.	• Assess reasons for TFLs not being used, such as: • TFL is not installed as designed or connected to adjacent habitats; • TFL is subject to noise or lighting disturbance (contractor to provide data); and / or • bats are using alternative existing commuting route (requires additional survey). • If either or both of the first reasons apply: • a review of the type(s) of TFL in use, and if alterations are required; • review of working hours and construction methodology in the vicinity of the TFL. • If there are no deficiencies or likely sources of disturbance, consider augmenting the TFL design / height / location. Otherwise, consider revised or further survey to determine how / where bats are commuting during construction, and complete further analysis if required to inform permanent mitigation measures.

Objective	Success measure	Survey methods	Expectations / tests	Indicative proposed remedial measures if tests not met
Objective 2: As above	• bats are using each feature / structure ('use' defined), in numbers which are similar to baseline use • bats are crossing the road at a 'safe' height, as confirmed using an NVA	vantage / crossing point surveys	• 90% of bats are recorded / observed using the green bridges / underpasses. • This test could be failed in two ways: • bats are not using the green bridge and underpass, but are not crossing unsafely (i.e. bats are no longer using this commuting route); and / or • bats are using this commuting route but crossing unsafely	• Assess reasons for <90% bats observed not 'using' the green bridge and underpass, such as: • green bridge is not installed as designed; • vegetation is in place but not sufficiently mature and / or not adequately connected; • green bridge and underpass are subject to noise and lighting disturbance because construction is not complete (contractor to provide data); and / or • bats are using alternative existing commuting route (requires additional survey). • The remedial actions will be determined by the reasons for failure of the specified test. This may include: • rectifying deficiencies in planting or establishment (replacing dead plants); • amending maintenance to account for weather, e.g., watering regime; • strengthening of landscape planting to augment connectivity; and / or • removal of barriers to crossing (sources of disturbance).

Objective	Success measure	Survey methods	Expectations / tests	Indicative proposed remedial measures if tests not met
Objective 3: To ensure that four currently known barbastelle colonies (confirmed presence during baseline surveys) remain or improve post-construction	• retention of barbastelle use of core and periphery zones and core sustenance zones recorded during the baseline; • no decline in barbastelle breeding status; and • no decline in barbastelle using the River Wensum for foraging and commuting (relative activity levels are consistent with baseline).	Radio-tracking surveys	• trapping records barbastelle in the same locations and approximately the same encounter rates as pre-construction; • baseline core sustenance and peripheral zones are largely unchanged, and there is no evidence that any colony has 'disappeared;' • breeding barbastelle are trapped; and • barbastelle are continuing to use the River Wensum for foraging and commuting (relative activity levels are consistent with baseline).	• review of data collected and comparisons between core and peripheral zones, review alongside weather and other environmental factors (Objective 4 and 5); and • review data alongside crossing point monitoring results, to determine whether trends are present across both Objective 2 and Objective 3. Remedial measures are as per Objectives 2, 4 and 5.
Objective 3: As above	Success Measures as above	ASD monitoring.	Static detectors record similar levels of barbastelle relative activity as pre-construction	Remedial measures as per ASD monitoring in Objective 1

Objective	Success measure	Survey methods	Expectations / tests	Indicative proposed remedial measures if tests not met
Objective 4: To ensure that the bat populations within the Red Line Boundary are not impeded by the changes in the environmental conditions associated with the Proposed Scheme both during construction and post-construction	• No overall decline in the baseline bat species assemblage due to lighting, noise and / or vibration during construction and operation.	Weather monitoring; and Lighting, noise, and vibration monitoring at TFLs, crossing structures, landscape treatment areas and retained roosts.	Weather is not considered to have negatively influenced the outcome of Objectives 1 – 3. Review of noise impact assessments and any associated mitigation / restrictions to determine that these are adequate. Lighting is being completed as per the agreed approach during construction and has not negatively influenced the outcome of Objectives 1 – 3.	• An assessment of Objective 4 will be undertaken in relation to Objectives 1 to 3. Implementation of changes would be subject to the below assessment and changes recommended where considered appropriate by the Named Ecologist. • assess if weather condition recorded during the monitoring period could account for the variances / changes recorded. • review measures provided within BNMMP, to assess changes in control measures with contractor input; and • review lighting used at each mitigation / compensation measure, inclusive of type of lighting, direction, level of light spill, etc.
Objective 5: To ensure the effects of habitat change within the Red Line Boundary are beneficial to bat populations within the Red Line Boundary in the longer term.	• Habitat creation in place and meeting KPIs as described in the LEMP	Habitat monitoring as outlined in the LEMP.	Habitat changes within the Red Line Boundary are considered to have positively influenced the outcomes of Objective 1 – 3.	• corrective management of vegetation. • review, and amendment of, irrigation systems / watering. • additional / replacement planting that may include replacement of failures, firming of stakes, ties, and guards; and • additional use of TFLs for commuting until vegetation develops. If planting failure is associated with severe weather events, a review of the landscape maintenance and management plan will be undertaken to ensure any lessons learned are applied to management during future severe weather events.

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